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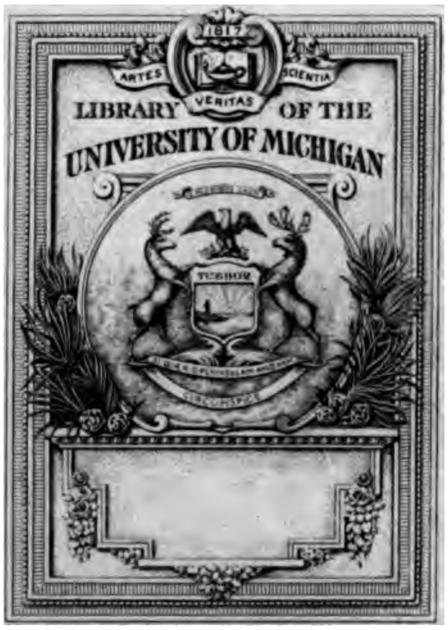

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BULLETIN

OF THE

UNITED STATES FISH COMMISSION.

VOL. XX,

FOR

1900.

SECOND PART.

GEORGE M. BOWERS, Commissioner.

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1902.

INVESTIGATIONS

OF THE

AQUATIC RESOURCES AND FISHERIES OF PORTO RICO

BY

THE UNITED STATES FISH COMMISSION STEAMER FISH HAWK

IN

1899.

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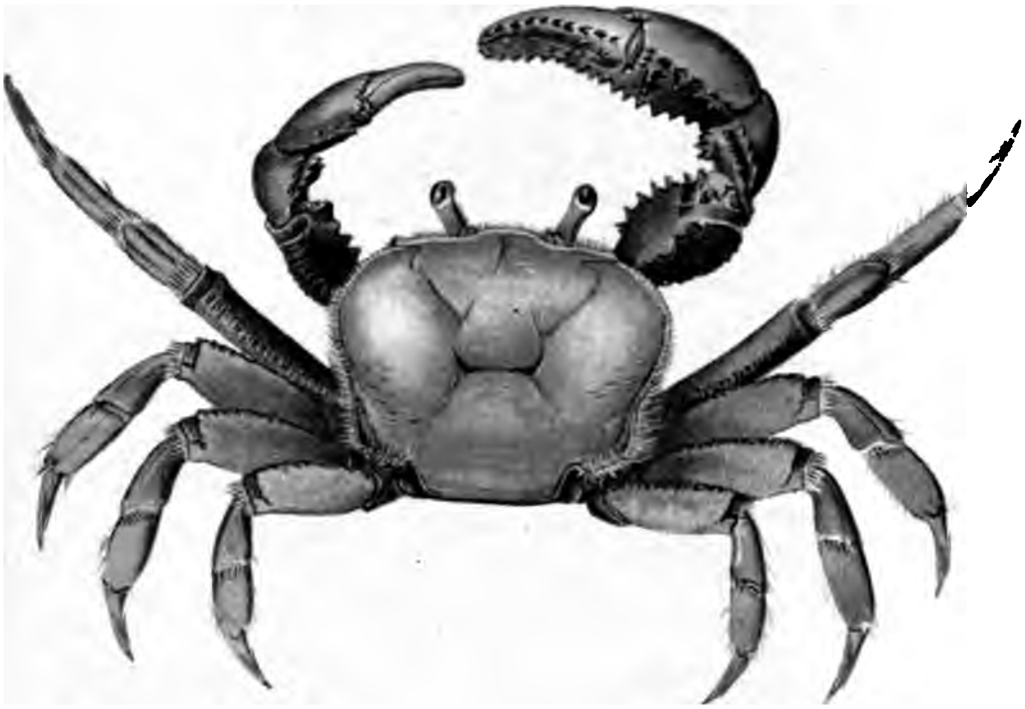
THE BRACHYURA AND MACRURA OF PORTO RICO.

BY

MARY J. RATHBUN,

Assistant Curator of Marine Invertebrates, U. S. National Museum.



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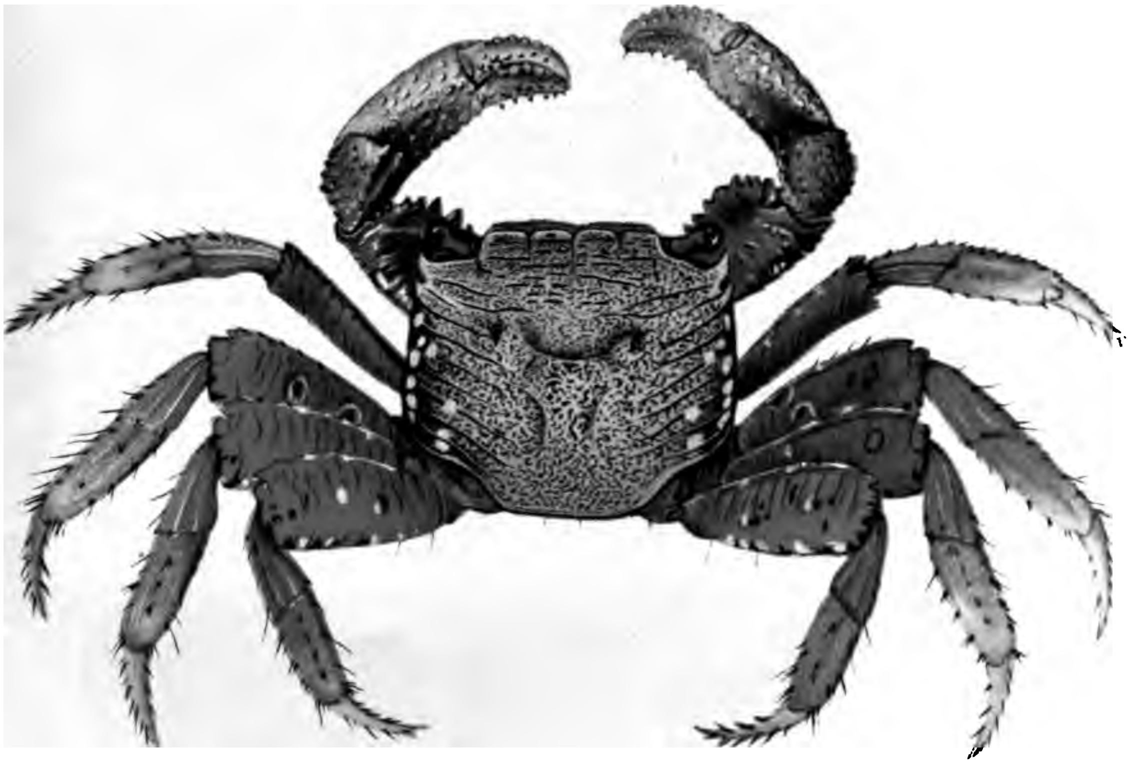

GONIOPSIS CRUENTATA, MALE, NATURAL SIZE

THE BRACHYURA AND MACRURA OF PORTO RICO.

By MARY J. RATHBUN,

Assistant Curator of Marine Invertebrates, U. S. National Museum.

The creatures described in the following paper belong to the well-known class of crustaceans, and to that division in which the eyes are mounted on stalks, usually movable, and the walking feet are ten in number.

The terms Brachyura and Macrura are here used in a limited sense, as defined by Dana, Stimpson, and Bate. In the Brachyura, or true crabs, the carapace or main part of the shell is usually wide and more or less flattened; the front part often projects to form a beak or rostrum; the antennæ are inconspicuous; the abdomen is small, bilaterally symmetrical, and folded under the carapace; of the five pairs of thoracic legs, the first pair are furnished with claws and are commonly larger than the remaining ones, which are similar.

The Macrura, or shrimps and lobsters, are elongated—that is, the carapace is longer than wide, and either subcylindrical or compressed; the rostrum is usually present, and often prominent; the antennæ are well developed; the abdomen or tail is longer than the carapace and is extensile; any or none of the relatively slender thoracic legs may be chelate.

Crabs and shrimps may be found along the seashore on the sandy and muddy bottoms, under stones, in crevices of rocks, corals, and sponges, in shells of living bivalve mollusks, in tubes of annelids, and on the tests of sea-urchins. They may be taken with the dredge and tangle from all depths of the sea; some species swim at the surface, others frequent brackish water at the mouths of rivers. Fluviatile crabs and shrimps occur in rivers and streams and along their banks, occasionally in ditches or among roots of trees, while the true land crabs may inhabit localities remote from salt or fresh water.

The only systematic list of Porto Rican decapodous crustaceans is that made by John Gundlach in his "Apuntes para la Fauna Puerto-Riqueña, VI, Crustaceos."[1] Fifty-two species are there enumerated, of which 37 are Brachyura and 8 are Macrura. The following list contains 162 Brachyura and 59 Macrura. These species were, with few exceptions, taken by the naturalists of the *Fish Hawk* in 1899. An examination has been made, also, of specimens collected by Dr. L. Stejneger, Dr. C. W. Richmond, and Mr. Paul Beckwith, of the U. S. National Museum; Mr. A. B. Baker, of the

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[1] Anales Soc. Españ. Hist. Nat., XVI, 115-135, 1887.

National Zoological Park; Mr. G. M. Gray, of Woods Hole, Mass., and Mr. L. M. McCormick, of the Glen Island Museum.

The crustaceans dredged by the *Fish Hawk* represent the fauna of the coast to a depth of 225 fathoms, although the majority of the species come from within the 100-fathom line. Our list also includes the fauna of the fresh waters and land crabs. One genus and 14 species of Brachyura and 1 genus and 13 species of Macrura are described as new. The types are in the U. S. National Museum.

The definitions of families and genera have been in large part quoted or condensed from other authors. The division into families is mainly that of Stebbing.[1]

In connection with the work on Porto Rican species, a large number of specimens of the same species in the West Indian collection of the National Museum have been determined, and the localities noted.[2]

List of dredging stations of the U. S. Fish Commission steamer Fish Hawk about the island of Porto Rico at which Brachyura and Macrura were collected.

Station No.	Date.	Locality.	Depth.	Bottom.	Dredging instruments.
	1899.		*Fathoms.*		
6051	Jan. 13	Off entrance to San Juan Harbor.	45	Sand, mud	Tangle.
6054	Jan. 16	San Juan Harbor	4½ to 5½	.....do	Dredge and tangle.
6055	Jan. 18	Off Aguadilla	137	Sand, mud, and shells.	Dredge.
6057	Jan. 19	Mayaguez Harbor	4½	Sticky mud	Do.
6058	Jan. 19	.....do	7½	.....do	7-foot beam trawl.
6059	Jan. 19	.....do	7	.....do	Do.
6060	Jan. 19	.....do	12	.....do	Dredge.
6061	Jan. 20	.....do	12 to 18	Sand, mud	11-foot beam trawl.
6062	Jan. 20	.....do	25 to 30	Sand, mud, and shells.	Dredge.
6063	Jan. 20	.....do	75 to 76	Rocky, sand, and coral	11-foot beam trawl.
6064	Jan. 20	.....do	22 to 33	Sand, mud	Dredge.
6065	Jan. 20	.....do	4 to 6	Coral	Do.
6066	Jan. 20	.....do	161 to 172	Sand, mud	11-foot beam trawl.
6067	Jan. 20	.....do	97 to 120	Coral	Dredge.
6070	Jan. 21	.....do	220 to 225	Rocky	9-foot beam trawl.
6072	Jan. 25	Off Punta de Melones	7¾	Coral, sand, shells	Tangle.
6073	Jan. 25	.....do	8	(?)	Dredge.
6074	Jan. 25	Off Puerto Real	8½	Coral, sand	Tangle.
6075	Jan. 25	Off Boca Prieta	8½	.....do	Do.
6076	Jan. 26	Off Gallardo Bank	10	.....do	Do.
6079	Feb. 6	Off St. Thomas	20 to 23	Coral	Do.
6080	Feb. 6	.....do	20	.....do	Dredge.
6084	Feb. 8	Off Vieques Island	11	Coral, sand, shells	Tangle.
6085	Feb. 8	.....do	14	Coral, sand	7-foot beam trawl.
6086	Feb. 8	Off Culebra Island	14¾	.....do	Dredge.
6087	Feb. 8	.....do	15½	.....do	Tangle.
6089	Feb. 8	Off Vieques Island	21	Coral	Do.
6090	Feb. 8	Off Culebra Island	16	.....do	Do.
6091	Feb. 8	Off Vieques Island	15	.....do	Do.
6092	Feb. 8	.....do	16	.....do	Do.
6093	Feb. 8	Off Culebra Island	15	.....do	Do.
6094	Feb. 8	Off Vieques Island	12	.....do	Do.
6095	Feb. 8	.....do	12½	.....do	Do.
6096	Feb. 8	.....do	6	.....do	Do.
6097	Feb. 8	Off Humaçao	10	.....do	Do.
6098	Feb. 8	.....do	12½	.....do	Do.
6099	Feb. 8	.....do	9½	.....do	Do.

---

[1] A History of Crustacea, 1893.

[2] This is, however, not true of the *Alpheidæ*, as the National Museum collection of that family has recently been sent to Dr. H. Coutière, of the Museum of Natural History, Paris, for study.

Suborder BRACHYURA. The Crabs.

Key to the Porto Rican tribes and families of the suborder Brachyura.

- A. Buccal frame quadrate; efferent branchial channels opening at sides of endostome.
  - B. Carapace usually quadrilateral. Frontal region curved downward. Verges of the male inserted either in sternal plastron or in the basal joints of fifth pair of legs, thence passing through channels in sternum beneath the abdomen.......Tribe *Catometopa*
    - C. Carapace hard and firm. Front, orbits, and eye-stalks not very small. Buccal frame quadrate anteriorly.
      - D. Last pair of legs not remarkably short nor subdorsal.
        - E. Carapace moderately convex or depressed; branchial regions not greatly dilated.
          - F. Third maxillipeds with palpus articulated usually at front inner angle of merus. Front of moderate width or very narrow. Eye-stalks often greatly elongate.......Family OCYPODIDÆ
          - F′. Third maxillipeds with palpus articulated at apex or front outer angle of fourth. Front usually broad. Eye-stalks of moderate size.......Family GRAPSIDÆ
        - E′. Carapace very convex, especially dilated over and in front of branchial regions; antero-lateral margins entire and strongly arcuate. Last joint of walking legs often armed with longitudinal rows of spines.......Family GECARCINIDÆ
      - D′. Last pair of legs very short and subdorsal.......Family PALICIDÆ
    - C′. Carapace more or less membranaceous. Front, orbits, and eye-stalks very small. Buccal frame arcuate anteriorly. Species of small size.......Family PINNOTHERIDÆ
  - B′. Carapace not quadrilateral. Verges of male inserted in basal joints of fifth pair of legs.
    - C. Carapace broad, short, rounded anteriorly, without projecting frontal rostrum.......Tribe *Cyclometopa*
      - D. Terminal joints of last pair of legs not flatly expanded.
        - E. Terminal joints of last pair of legs usually spinuliferous. Species fluviatile, or living in damp earth away from the sea.......Family POTAMONIDÆ
        - E′. Terminal joints of last pair of legs usually unarmed. Species marine.......Family PILUMNIDÆ
      - D′. Terminal joints of last pair of legs usually flatly expanded. Front well separated from inner orbital angles.......Family PORTUNIDÆ
    - C′. Carapace usually triangular, with projecting pointed or spined rostrum.......Tribe *Oxyrhyncha*
      - D. Basal joint of antennæ well developed, inserted beneath the eyes, and usually forming a great part of infraocular space.......Family MAIIDÆ
      - D′. Basal joint of antennæ very small, and with the next joint embedded in the narrow gap between front and inner orbital angle.......Family PARTHENOPIDÆ
- A′. Buccal frame usually triangular, narrowed forward; efferent channels opening at middle of endostome. Verges of male inserted in basal joints of fifth pair of legs.......Tribe *Oxystomata*
  - B. Last one or two pairs of feet not articulated higher up than the preceding pairs.
    - C. Afferent channels to branchiæ opening behind pterygostomian regions and in front of chelipeds.
      - D. Palpus of the outer maxillipeds not concealed.......Family CALAPPIDÆ
      - D′. Palpus of the outer maxillipeds concealed behind triangular acute merus.......Family MATUTIDÆ
    - C′. Afferent channels to branchiæ opening at antero-lateral angles of endostome.......Family LEUCOSIIDÆ
  - B′. Last one or two pairs of feet articulated higher up than preceding pairs.......Family DORIPPIDÆ

Tribe CATOMETOPA or GRAPSOIDEA.

Carapace broad anteriorly, often subquadrate, sometimes subglobose, truncate or arcuate anteriorly, but not rostrate. Front bent downward. Epistome short, often almost linear. The pairs of branchiæ are usually fewer than nine in number; the efferent channels open at the sides of the endostome. The male verges are inserted either in the sternal plastron or in the basal joints of the last pair of legs, thence passing through channels in the sternum beneath the pleon.

Family OCYPODIDÆ Leach, 1819.

Carapace in general moderately convex, either cancroid or trapezoidal, with antero-lateral margins straight or arcuate, the branchial regions not generally dilated. The front is of moderate width or very narrow. The orbits and eye-stalks are of moderate size or greatly developed. The chelipeds in the adult male are in general of moderate size, sometimes slender and elongate. The seventh joint in the walking legs is styliform, without strong spines. The pleon does not always cover the whole width of the sternum between the last pair of legs.

Key to the Porto Rican genera of the family Ocypodidæ.

A. Carapace trapezoidal or quadrate. Eye-stalks elongate.
  B. Lateral margins entire.
    C. Eye peduncles stout; chelæ in male somewhat unequal .... *Ocypode*
    C'. Eye peduncles slender; chelæ in male extremely unequal .... *Uca*
  B'. Lateral margins toothed.
    C. Antennæ excluded from the orbit by internal suborbital lobe .... *Euryplax*
    C'. Antennæ not excluded from the orbit .... *Tetraplax*
A'. Carapace with antero-lateral margins arcuate. Eye-stalks of moderate length.
  B. Carapace rectangular posteriorly.
    C. Antero-lateral margin not dentate .... *Chasmocarcinus*
    C'. Antero-lateral margin dentate .... *Speocarcinus*
  B'. Carapace cancroid in form; postero-lateral margins converging posteriorly.
    C. Chelipeds with palm more or less angular. Fingers elongate .... *Eucratopsis*
    C'. Chelipeds with palm robust. Fingers short .... *Panoplax*

Genus OCYPODE Fabricius.

Ocypode Fabricius, Entom. Sys., Suppl., 312, 1798.

Orbits very large and open, extending all along the anterior margin on either side of the narrow and deflexed front. Eye-stalks large, the large corneæ covering much of the lower surface of this terminal joint. Chelipeds in the adult male are unequal and well developed, and the palm has a vertical series of short raised lines or tubercles on the inner surface, which form a stridulating ridge.

Ocypode albicans Bosc. *Sand Crab; Ghost Crab.*

Ocypoda albicans Bosc, Hist. Nat. Crust., I, 196, pl. 4, f. 1, 1802.
Ocypode arenarius Say, Jour. Phila. Acad. Sci., I, 69, 1817.
Ocypode arenaria Miers, Ann. Mag. Nat. Hist. (5), X, 384, pl. XVII, figs. 7, 7*a*, 7*b*, 1882; Rathbun, Ann. Inst. Jamaica, I, 26, 1897.
Ocypode albicans Rathbun, Proc. Wash. Acad. Sci., II, 134, 1900.

Carapace coarsely granulate toward the sides, finely granulate on middle and posterior portions. Antero-lateral angles acute and prominent. Eyes rounded at the distal extremity. Stridulating ridge narrow, tuberculate. Ambulatory legs compressed, with long, yellow, marginal hairs.

Dimensions of male from Nassau: Length, 34 mm.; width, 41 mm.

From Long Island to Brazil; Bermudas. Porto Rico (Gundlach). Taken by the *Fish Hawk* party at Nassau, Bahamas, and the following Porto Rican localities: San Juan, Aguadilla, Puerto Real, Playa de Ponce, Hucares, Fajardo, and Ensenada Honda, Culebra.

The *Ocypode rhombea* listed by Gundlach probably does not differ specifically from his *Ocypode arenaria*.

Found on sandy beaches, where they dig holes at and above high-water mark. They live on refuse thrown up by the tide, and are partly nocturnal. Their color is that of the sand, and they are very swift of movement.

Genus UCA Leach. Fiddler Crabs.

Uca Leach, Edin. Encyc., VII, 430, 1814 (not *Uca* Latreille, 1819): Rathbun, Proc. Biol. Soc. Wash., XI, 154, 1897.
Gelasimus Latreille, Nouv. Dict. Hist. Nat., XII, 517, 1817.

Orbits extending all along the anterior margin of the carapace on either side of the comparatively narrow front. Eye-stalks long and slender. Chelipeds in the adult male strikingly unequal; in the female small and equal.

Key to the Porto Rican species of the genus Uca.[1]

A. Front wide, for the genus.
  B. Oblique ridge on inner surface of palm terminating at carpal cavity.
    C. The two rows of tubercles on inner surface of palm at base of dactylus are divergent from below upward and leave a considerable space between them .... *mordax*
    C'. The two rows of tubercles at base of dactylus are subparallel and near together .... *pugnax rapax*
  B'. Oblique ridge not terminating at carpal cavity, but continued to near superior margin of palm .... *leptodactyla*
A. Front very narrow, but not linear nor spatuliform .... *thayeri*

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[1] Gundlach recognizes the presence of the fiddler crab in Porto Rico under the name "*Gelasimus vocator*."

Uca mordax (Smith).

Gelasimus mordax Smith, Trans. Conn. Acad. Sci., II, 135, pl. II, f. 3, pl. IV, f. 4, 4*a*, 1870.
Uca mordax Rathbun, Proc. U. S. Nat. Mus., XXII, 276, 1900.

Front broad and shallow; width at base or posteriorly about one-third the width between the anterior angles of the carapace; anterior margin almost straight. Lateral margin of carapace strongly curved inward anteriorly and forming blunt angles. Palm elongate, narrow toward the carpus; the oblique ridge on its lower inner surface is usually tuberculate and very much thickened, being several tubercles in width. In the Porto Rican specimens these tubercles are almost obsolete except at the proximal end of the ridge. The two rows of tubercles at the base of the dactylus on the inner surface of the palm are not parallel, but diverge from each other toward the upper margin.

A large species, over an inch in width. Length of male from Hucares, 16.4 mm.; width 27 mm.

From the Bahamas and the West Indies to Rio de Janeiro; Liberia (?). Rio Bayamon, above Palo Seco, 2 females; Hucares, 4 males.

Uca pugnax rapax (Smith).

Gelasimus rapax Smith, Trans. Conn. Acad. Sci., II, 134, pl. II, f. 2, pl. IV, f. 3, 1870.

Front with arcuate margin; width at base or posteriorly about two-sevenths the width between anterior angles of carapace. Lateral margin curved inward anteriorly, forming acute angles. Palm proportionally shorter and proximally broader than in *U. mordax;* the oblique ridge on its lower inner surface is formed of large tubercles and does not terminate so near the carpus as in *U. mordax*, and consequently is more oblique to the lower margin. The two rows of tubercles at base of dactylus are near together and subparallel. Smaller than *U. mordax*, usually less than an inch in width. Measurements of male from Boqueron Bay: Length, 14.5 mm.; width, 22.5 mm.

The subspecies which I designate under the name of *Uca pugnax rapax* is a West Indian form of fiddler, differing from the common *U. pugnax* of the east coast of the United States chiefly as follows: In *U. pugnax* the superior orbital border or eyebrow is nearly vertical and barely visible in a dorsal view, while in *U. pugnax rapax* the eyebrow is more oblique and readily visible from above. In *U. pugnax* the space between the dactylus and carpal cavity is coarsely granulate; in *U. pugnax rapax* finely granulate.

Florida Keys to Rio de Janeiro. In Porto Rico at Cataño; San Juan; Boqueron Bay, very numerous; Ensenada Honda, Culebra; Hucares, numerous; Fajardo.

The typical form of *U. pugnax* extends from Provincetown, Mass., to Georgia.

Frequents salt marshes. Taken in the mangrove swamps at San Juan Bay, Porto Rico.

Uca leptodactyla Rathbun.

Uca leptodactyla (Guérin MS.) Rathbun in Rankin, Ann. N. Y. Acad. Sci., XI, 227, 1898.

A small species, a little over a third of an inch wide, thicker and more cylindrical than any other of the Porto Rican species of *Uca*. The front at its base or posteriorly is about one-fourth the width between anterior angles of carapace. These angles are directed obliquely outward. The oblique ridge on lower half of inner surface of palm does not terminate at the carpal cavity, but is continued by an angular turn to near the superior margin of palm. This upper half of the ridge is parallel to the tubercular ridge at base of dactylus. Fingers of great claw very slender and delicate. Ambulatory legs light colored and marked with small dark spots, which form in part transverse bands.

Length of male from San Juan, 6 mm.; width, 9.8 mm.

Bahamas and West Indies to Santos, Brazil. Porto Rico: San Antonio Bridge, San Juan; Boqueron Bay; Ensenada Honda, Culebra; Fajardo.

Uca thayeri Rathbun.

Uca thayeri Rathbun, Proc. Washington Acad. Sci., II, 134, pl. VIII, figs. 1 and 2, 1900.

Carapace very broad in its anterior fourth, narrowing rapidly in its posterior three-fourths; antero-lateral angles almost rectangular, blunt; sometimes the carapace is narrower at orbital angles than a little behind that point, caused by the curving inward at lateral angle of one or both lateral margins. Dorsal furrows deep, especially the cervical and the transverse gastro-cardiac furrow; less deep are the obliquely longitudinal branchial furrow and the postorbital. Surface finely and densely granulate through the lens, and tomentose, the hair retaining particles of mud. Front very narrow, not linear nor spatuliform, but subtriangular, at base or posteriorly less than one-fifth the width between the antero-lateral angles of the carapace, anteriorly truncate or nearly so; sides oblique and almost straight;

superior orbital surface or eyebrow shallow, not varying much in length throughout its width; margins finely granulate. Inferior margin of orbit with large truncate tubercles, increasing in size and distance apart toward the outer extremity.

Large cheliped very heavy. Merus and carpus elongate, thick, rugose on the outer surface, and without armed margins. Outer surface of palm coarsely tuberculate on its upper half, the tubercles gradually becoming fine granules below; upper and lower margins set off by deep grooves. Inner surface of palm with a ridge marked by a single line of large tubercles, leading obliquely upward from the lower margin to the carpal cavity, where it turns at a little less than a right angle and is continued less than halfway to the upper margin, or when continued farther the tubercles are obsolete. On the palm at the base of the dactylus are two tuberculate lines, the distal one very short; both are slightly oblique to the lower margin. In full-grown males the fingers are very long, the lower margin of the propodus sinuous, the pollex bent down for its distal third. The dactylus equals or overreaches the pollex. The prehensile tubercles are irregular, but not strikingly so. The dactylus is roughened at its base on the upper side and has a short longitudinal groove on the outer side below the upper margin. The smaller cheliped is rather long, the fingers longer than the palm and somewhat gaping to the tips. Meral joints of ambulatory legs dilated and very broad, especially those of second and third pairs.

Old males show a tendency to widen behind the antero-lateral angles; this tendency is stronger on the side of the large claw. In males which are young or have not reached their fullest development the pollex of the large chela is straight, not bent down, and the lower margin of the propodus is convex, not sinuous. The meral joints of the ambulatory legs are wider in the female than in the male, as is the case in other species of the genus.

Male, length, 17.2 mm.; width, 27.5 mm.

Jamaica; Brazil at Natal, Rio Grande do Norte, also Rio Parahyba do Norte, Saõ Matheos and Victoria. Porto Rico: Rio Bayamon above Palo Seco, 2 adult males with straight propodi, 1 adult female; Fajardo, 1 male, 1 female, both small but mature, large cheliped of male missing.

Genus EURYPLAX Stimpson.

Euryplax Stimpson. Ann. Lyc. Nat. Hist. N. Y., VII, 60, 1859; Bull. Mus. Comp. Zool., II, 150, 1871.

Carapace transverse, broad; antero-lateral margin very short, dentate; front nearly half as broad as the carapace; ocular peduncles of moderate length; antennal flagellum excluded from the orbit by a process of the basal joint, which joins the front. Palpus of the endognath of the outer maxillipeds articulating with the merus at its inner angle.

Verges of the male arising from coxæ of fifth pair of feet and passing through canals in the sternum. Sternum partially exposed in the sinus of the abdomen between its second and third segments. All the segments of abdomen distinct. Chelipeds heavy, not very unequal.

Only one species known from West Indian region, viz, *E. nitida* Stimpson, the type of the genus.

Euryplax nitida Stimpson.

Euryplax nitidus Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 60, 1859; Smith, Trans. Conn. Acad. Sci., II, 162, 1870.
Euryplax nitida Stimpson, Bull. Mus. Comp. Zool., II, 150, 1871; Kingsley, Proc. Acad. Nat. Sci. Phila., XXXI, 399, 1879.

Carapace smooth and shining, convex fore and aft, as well as from side to side; antero-lateral margin less than half as long as the postero-lateral, and armed with three strong teeth including the angle of the orbit; carapace widest at the third tooth. Front deeply notched on each side at the insertion of the antennæ; inter-antennal margin nearly straight. Chelipeds in the male with a round pit at anterior distal corner of lower surface of merus; this pit is surrounded by a fringe of long hair; a sharp curved spine near the distal end of the upper surface of the merus. Carpus with a sharp inner spine; inner surface pilose. Ambulatory legs slender. Carapace of female narrower. Chelipeds more nearly equal. Merus without pit and surrounding hair.

The dimensions of two specimens are as follows:

Sex.	Locality.	Length.	Width at third tooth.	Width at orbital tooth.
Male.	Cedar Keys, Fla	15	24.9	20.8
Fem.	Marco, Fla	15	24	20.8

West coast of Florida and Florida Keys to 49 fathoms (Stimpson); St. Thomas (Stimpson). Off Vieques, 14 fathoms, coral, sand, shells, station 6085, 1 small male.

Genus TETRAPLAX, nov.

Carapace quadrilateral; lateral margins dentate, somewhat converging posteriorly. Front about one-third the width of the carapace, margin nearly straight. Orbital margins nearly transverse. Eyestalks elongate and of moderate thickness. Antennæ entering the orbit. Buccal cavity wider in front than behind. Maxillipeds not completely filling the cavity; palpus articulating at the front inner angle of merus, which is slightly notched. Abdominal segments in male narrower than the sternum; third to fifth segments fused. Chelipeds unequal, heavy, angular; fingers pointed. Ambulatory legs long, slender, compressed; dactyli of last pair concave upward and outward.

Type, *Frevillea quadridentata* Rathbun, a species described from the female only. Having recently compared the male with the male of *F. barbata* A. Milne Edwards, I find the species generically distinct. *Frevillea* has very oblique orbital margins, terminating in a prominent antero-lateral spine, very stout eyes, while the abdomen of the male is very broad at base, covering the sternum.

Tetraplax quadridentata Rathbun.

Frevillea quadridentata Rathbun, Bull. Labor. Nat. Hist. State Univ. Iowa, IV, p. 287, pl. VIII, f. 1, 1898.

Carapace thick, about three-fourths as long as wide, covered with a short, dark-colored pubescence; when this is removed, the regions can be made out. Front about one-third the width of carapace, deflexed, edge thin, from above appearing slightly emarginate. Superior margin of orbit sloping outward and slightly backward to outer orbital tooth; a notch toward inner end, and another next outer tooth. The inferior margin has a notch next the outer tooth and a tooth at inner angle, between which and the antenna there is a triangular opening. Antero-lateral margin with three teeth besides the orbital; their outer edges are finely denticulate; the three teeth are very nearly in a line parallel to middle line of crab; orbital tooth less projecting. Postero-lateral margins longer than antero-lateral, and moderately converging. The sutures between the third and fourth, and fourth and fifth segments of abdomen of male are partially indicated. Terminal segment rounded at extremity. Chelipeds subequal, rather heavy. Merus with a spine on its superior margin at its distal third. Carpus with an inner spine and an anterior fringe of hair. Hand smooth and shining, finely granulate above, upper margin acute and very finely granulate. Lower outer margin of pollex with a granulated costa. Dactylus with two superior granulated costæ and a superior fringe of hair.

The dimensions of three specimens from San Juan Harbor are as follows:

Sex.	Length.	Width.	Width at antero-lateral angles.	Width of front.
Male	8.3	10.3	9	3.5
Ovigerous female	8.1	10.4	9.1	3.6
Male	5.8	6.8	6.4	2.5

San Juan Harbor, 4½ to 5½ fathoms, sand, mud, station 6054, 2 males, 1 female; Mayaguez Harbor, 12 fathoms, sticky mud, station 6060, 1 male. One specimen only, a female, had been taken previously by the *Albatross* at Curaçao. Three of the Porto Rican specimens are larger than the type and show that the species becomes relatively narrower as it increases in size.

Genus CHASMOCARCINUS Rathbun.

Chasmocarcinus Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 284, 1898.

Carapace thick, broadest posteriorly, tapering anteriorly, without antero-lateral angles, the lateral margins forming a curve continuous with the anterior margin. Front narrow, bifid. Orbits marginal, oblong; eyes movable. Pterygostomian region with a horizontal suture as in *Scalopidia*. Antennula with basal joint very large and hemispherical. Epistome nearly perpendicular, its margin projecting below the maxillipeds. Maxillipeds widely separated throughout their length, longitudinally placed. Merus suboval, the palpus articulating at the antero-internal angle. Abdomen much narrower at base than the sternum; third, fourth, and fifth segments coalesced in the male. The sexual appendages pass to the coxæ through ducts visible between the sternal segments. Abdominal segments distinct in the female. Chelipeds with merus trigonal, carpus quadrate, manus short and broad, fingers long and slender. Ambulatory legs slender, subcylindrical, the third pair the longest, the second next, the fourth the shortest. Dactylus of last pair recurved.

Chasmocarcinus cylindricus, sp. nov.

Length of carapace less than three-fourths its posterior width. Fronto-orbital width about half width of carapace. Carapace subcylindrical, almost level from side to side. Anterior half of lateral margin marked by a sharp granulated line. Sutures visible about cardiac region. At inner angle of the branchial region there is a depression from which various shallow wrinkled furrows radiate. Surface covered with a short pubescence. Front a little wider than either orbit; margin subtruncate, upper surface with a median depression, which in a dorsal view makes the margin appear bifid. Margin of orbit concave, directed obliquely outward and a little forward. Right cheliped larger than the left. Carpus with inner angle rounded, and without a tooth. Manus of larger cheliped about one-half wider than that of smaller in the male, and much more swollen, its fingers gaping at base; in the female the hands are more nearly equal and the fingers do not gape. Ambulatory legs narrow, fringed with hair.

The following are the dimensions of two specimens:

Locality.	Sex.	Length.	Width.	Fronto-orbital width.
Station 6061......	Male	4.6	6.5	3.5
Station 6059......	Female.......	6.7	9.5	4.7

This species is distinguished at a glance from the three previously described, by its broader and more cylindrical carapace.

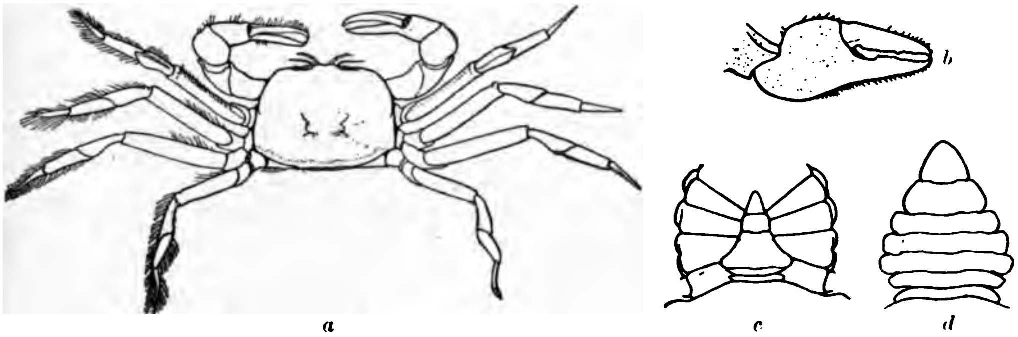

FIG. 1.—*Chasmocarcinus cylindricus.* (*a*) Female, dorsal view, × 2. (*b*) Large chela of male, × 2.66. (*c*) Abdomen of male, × 4. (*d*) Abdomen of female, × 4.

Type locality, Mayaguez Harbor, Porto Rico, 12 to 18 fathoms, sand, mud, station 6061, 4 males, 2 females (Cat. No. 23765). Other Porto Rican localities are off Aguadilla, 137 fathoms, sand, mud, and shells, station 6055, 1 female; Mayaguez Harbor, 7 fathoms, sticky mud, station 6059, 1 female; Mayaguez Harbor, 75 to 76 fathoms, rocky, sand, and coral, station 6063, 1 male, 3 juv.; Mayaguez Harbor, 161 to 172 fathoms, sand, mud, station 6066, 2 males, 2 females.

Genus SPEOCARCINUS Stimpson.

Speocarcinus Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 58, 1859.

Carapace longitudinally convex, almost semicylindrical, transversely nearly flat; posteriorly narrowing very little, anteriorly margins arcuate and dentate. Front less than half the width of carapace. Orbits marginal, oblong, eyes movable. Outer maxillipeds moderately separated from each other; merus subquadrate, with a notch at antero-internal angle for the insertion of palpus. First two abdominal segments narrow, exposing largely the sternal segment; third segment much wider, but still not extending to coxal joints of legs; third, fourth, and fifth segments coalesced. Chelipeds short, thick. Ambulatory legs narrow, smooth, compressed; dactyli long, ciliate.

Speocarcinus carolinensis Stimpson.

Speocarcinus carolinensis Stimpson, Ann. Lyc. Nat. Hist. N. Y., vii, 59, pl. i, figs. 1, 2, and 3, 1859; Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, iv, 281, 1898.

Carapace punctate, obsoletely granulated toward margins. Gastric region well defined. Anterolateral region 5-toothed, including angle of orbit; second tooth shallow, rounded, and not distinctly separated from first. Third, fourth, and fifth teeth well marked, sharp, separated by clearly marked U-shaped sinuses. Front about one-third width of carapace, with a median notch; the two lobes slightly oblique and sinuous. Merus of chelipeds with a strong tooth above near distal end; carpus with a blunt tooth at inner angle; hand smooth, punctate. Dactylus of last pair of ambulatory legs curved upward. Surface pubescent except that of the fingers. Lines of hairs on the hands and fingers and the margins of the ambulatory legs.

Male, station 6074: Length, 6.5 mm.; width, 8.5; width between outer angles, 6; width of front, 3. Female, station 6074: Length, 7.5; width, 9.8; width between outer orbital angles, 6.5; width of front, 3.2 mm.

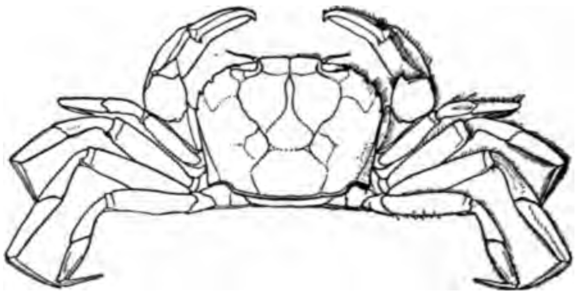

Fig. 2.—*Speocarcinus carolinensis*, female, × 2.33.

Charleston Harbor, S. C. (type locality), in subterranean galleries excavated in mud at low-water mark by other crustaceans or by large worms. Tortugas, dredged. Mayaguez Harbor, Porto Rico, 12 to 18 fathoms, station 6061, and in 75 to 76 fathoms, station 6063; off Puerto Real, 8½ fathoms, station 6074.

The Porto Rican specimens are wider than the type, which was measured by Stimpson and is not extant, their lateral teeth are more distinctly separated, and the second tooth more prominent than in Stimpson's figure. The specimen from Tortugas which I referred to *S. carolinensis* in 1898, though smaller than the type, has the same proportions and similar teeth. There is, however, in the Museum of Comparative Zoology, a male from Charleston, S. C., the type locality, which is about the same size as the type specimen, but its proportionate width is intermediate between the type and the Porto Rican specimens, while the teeth are prominent and well separated, as in the latter.

Genus EUCRATOPSIS Smith.

Eucratopsis Smith, Trans. Conn. Acad. Sci., ii, 35, 1869.

Carapace convex in an antero-posterior and a transverse direction, narrowing considerably posteriorly, antero-lateral margins with large teeth. Front less than half the width of carapace. Orbits and maxillipeds similar to those of *Speocarcinus*. Third abdominal segment not in contact with coxæ of fifth pair of feet in typical species; third, fourth, and fifth segments coalesced. Chelipeds short, thick; palm angular, with a distinct superior marginal line; fingers elongate.

Eucratopsis spinidentata (Benedict).

Eucratoplax spinidentata Benedict, Johns Hopkins Univ. Cir., xi, No. 97, p. 77, 1892; Rathbun, Ann. Inst. Jamaica, i, 26, 1897.
Eucratopsis spinidentata Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, iv, 281, 1898.

Carapace finely granulate and pubescent. Regions distinctly marked. Front less than one-third the width of carapace, bilobed, lobes slightly rounded. Orbit slightly wider than frontal lobe. Lateral teeth five, including orbital; the second shallow and separated from the first by only a slight sinus; third rounded, obtuse, and little projecting; fourth and fifth prominent, spiniform. Merus of chelipeds with a superior tooth near distal end; carpus with two spiniform teeth, one at inner angle, the other below. Palm smooth on outer face, granulate above; fingers slightly bent down in the larger cheliped, more so in the smaller cheliped. Teeth of fingers irregular; when closed the fingers leave a slight gape proximally. Ambulatory legs pubescent and with hairy margins. Dactyli of last pair slightly recurved and bent upward.

Length of male from Boqueron Bay, 11 mm.; width between penultimate marginal teeth, 15.5 mm.; width between outer orbital angles, 9.8 mm.; width of front, 4.8 mm.

Jamaica (Benedict, Rathbun); Trinidad; Monos Island, off Trinidad; Puerto Real and Boqueron Bay, Porto Rico.

Genus PANOPLAX Stimpson.

Panoplax Stimpson, Bull. Mus. Comp. Zool., II, 151, 1871.

Carapace arcuate anteriorly, quadrate posteriorly; front advanced; antero-lateral margin dentate. Merus of outer maxillipeds with inner posterior margin notched; also the inner anterior angle notched for articulation of palpus. Chelipeds heavy, palm robust; fingers short. Ambulatory legs narrow. First segment of abdomen of male is wide, covering the sternum; the second narrower, exposing the sternum; the third wider than second, but still not reaching the coxæ of fifth pair of feet.

Panoplax depressa Stimpson.

Panoplax depressa Stimpson, Bull. Mus. Comp. Zool., II, 151, 1871.

Carapace depressed, regions fairly well marked, surface finely punctate, granulate along the lateral teeth; two oblique epigastric lobes. Front with two rounded lobes. Superior orbital margin with two notches; orbit as wide as each frontal lobe. Lateral teeth five, including orbital; the second shallow, separated from first by a shallow sinus; the third large, blunt, outer margin very arcuate; fourth triangular, with a spiniform tip; fifth very small, not projecting beyond general outline. Postero-lateral margins moderately converging posteriorly. Chelipeds unequal; merus and carpus granulate toward the margins; merus dentate on superior margin; carpus oblong, with a stout blunt tooth at the inner angle and a few tubercles below it; an anterior transverse groove. Hands smooth and rounded, punctate; fingers dark brown, color not extending to palm; prehensile teeth broad, low, a larger one at base of dactylus; no gape. In the female the upper surface of the manus is flattened, with traces of two longitudinal carinæ and an intermediate furrow. Meral joints of ambulatory legs roughened on anterior margins, following joints hairy.

Length of male, 6.8 mm.; width, 9.5 mm.; width between outer orbital angles, 6.5 mm.; width of front, 3 mm.

East and Middle Keys, Tortugas, 5 to 7 fathoms (type locality); Jamaica. Porto Rico: Mayaguez Harbor, 4 to 6 fathoms, station 6065; off Punta de Melones, 7½ fathoms, station 6072; off Humaçao, 9½ fathoms, station 6099; Ensenada Honda, Culebra.

Family PALICIDÆ Rathbun, 1898.

Carapace broadly transverse, subquadrilateral; antero-lateral margins dentate. Fronto-orbital width great, front dentate. Orbits and eyes large. Buccal cavity quadrate; outer maxillipeds not covering it; ischium strongly produced forward on the inner side; merus small, subtriangular, with a notch on the inner distal side for the articulation of the palpus. Afferent channels to branchiæ opening at bases of chelipeds; efferent channels at antero-external angles of buccal cavity. Chelipeds of moderate size, often unequal in the male; usually tuberculate or granulate. Next three pairs of feet long, slender, and rough. Last pair very short and slender, subdorsal, smooth. Abdomen of male much narrower than the sternum.

This family contains only one genus.

Genus PALICUS Philippi.

Cymopolia Roux, Crust. Médit. (page 77), 1828. (Name preoccupied.)
Palicus Philippi, Zweiter Jahresber. d. Vereins f. Naturk. in Cassel, 11, 1838.

Characters of the family.

Key to the Porto Rican species of the genus Palicus.

A. Abdomen and sternum with conspicuous laminiform expansions, visible in a dorsal view .... *alternatus*
A′. Abdomen and sternum without conspicuous laminiform expansions, visible in a dorsal view .... *sica*

Palicus alternatus Rathbun.

Palicus alternatus Rathbun, Proc. Biol. Soc. Wash., XI, 95, 1897.

Carapace subquadrate, coarsely granulate. Front with four distinct lobes, the median pair smaller and more deeply separated from each other than from outer pair. Superior orbital lobes subquadrate; outer margin of outer orbital tooth nearly straight; median lobe of inferior margin most advanced at its inner angle. Lateral teeth two, broad, lobate, obtuse; in large specimens a third very small tooth or tubercle behind the second.

There are two forms of the male in this species. In one the appendages of first segment of abdomen are strong and twisted, tip bilobed, inner lobe thinner and longer than outer. In the second form the appendages are weaker and not twisted, the tip less spreading. In the first form, the chelipeds are very unequal, the left always slender and weak, the right large and heavy. Both chelipeds tuberculate and pubescent. Carpus covered with irregular laminiform lobes; manus surmounted by a double crest of same. Width of right manus at its distal end equals one-half length of carapace. Pollex very short. Dactylus strongly bent down, overlapping pollex at tip. Left manus a little more than one-third width of right, enlarging but little toward the long and rather narrow fingers. In the second form of the male the right manus is about twice the width of left and its fingers are also long and slender. In the female the hands are more nearly equal. The second ambulatory leg is about twice the length of carapace; the first reaches about the middle of propodus of second; the third reaches about middle of dactylus of second. The meri are rough with squamose tubercles, and have two longitudinal grooves on upper surface and one on anterior surface. The anterior margin terminates in a blunt rectangular tooth in the second and third pairs; in the first pair this tooth is produced outward toward the carpus. Posterior margin of the dactyli concave as a whole, but nearly straight for the proximal two-thirds.

Dimensions of male, form I: Length, 6.6 mm.; width, 7.6 mm.; length of second ambulatory leg, 14 mm.; length of merus, 4.4 mm.; carpus, 2.2 mm.; propodus, 3.6 mm.; dactylus, 3.2 mm. Male, form II: Length, 11 mm.; width, 13.2 mm.

Off St. Thomas, 20 to 23 fathoms, station 6079, *Fish Hawk*, 1 male, form I, and 1 young female. From off Cape Hatteras to the Gulf of Mexico, 24 to 60 fathoms.

Palicus sica (A. Milne Edwards).

Cymopolia sica A. Milne Edwards, Bull. Mus. Comp. Zoöl., VIII, 29, 1880 (part).
Palicus sica Rathbun, Proc. Biol. Soc. Wash., XI, 97, 1897.

Carapace granulate, many of the granules forming clusters on the more elevated regions. Front with four small tuberculiform teeth, the median the most prominent, separated from each other by a deep triangular notch and from the lateral teeth by very broad shallow sinuses. The tooth of the superior orbital border nearest preorbital is arcuate; the next narrower, also obtuse. The median suborbital lobe is subtriangular and much less advanced than inner lobe. The lateral margin of carapace bears three small thickened teeth. Just above posterior margin a sinuous line of tubercles. First segment of abdomen with a narrow carina on either side behind the postero-lateral angle of carapace. Second carinated throughout its width, the carina much longer in center. Third segment carinated, but much less sharply. A carina on sternum, in a line with suture between second and third abdominal segments, extends well outwardly, but not so far posteriorly as the second abdominal. These carinæ form horizontal plates, visible in a dorsal view, excepting that of the third abdominal segment in the male. Chelipeds slender and feeble. Ambulatory legs of moderate length, the third very little shorter than second, the first very slender and reaching about midway of carpus of second; merus of second pair long and comparatively narrow; of second and third pairs with longitudinal rows of spinules, and a deep groove on anterior half; anterior distal angles subrectangular.

Length of adult female, 9.8 mm.; width, 13.5 mm. The width varies from 1.25 times its length in small specimens to 1.39 times its length in large ones.

Mayaguez Harbor, 97 to 120 fathoms, station 6067, 1 young male. From the Gulf of Mexico and Florida Keys to Barbados and Grenada, 60 to 117 fathoms.

Family GECARCINIDÆ Milne Edwards, 1837. Land Crabs.

Carapace dorsally very convex, especially dilated over and in front of the branchial regions, with the antero-lateral margins usually entire and strongly arcuate. The front is of moderate width and strongly deflexed. The orbits and eye-stalks are of moderate size. The third maxillipeds have the fifth joint articulated at the front outer or near the front inner angle or at the apex of the fourth, which sometimes completely conceals it. The chelipeds in the adult male are powerful, usually unequal. The seventh joint in the walking legs is nearly always granulated and armed with longitudinal rows of spines. The pleon of the male usually covers the whole space between the bases of the last pair of walking legs.

Key to the Porto Rican genera of the family Gecarcinidæ.

A. Palpus of outer maxillipeds inserted on inner face of merus near its summit and concealed under the joint.. *Gecarcinus*
A′. Palpus of outer maxillipeds inserted at external angle of merus and exposed to view.
  B. Inner edges of ischium and merus of outer maxillipeds in one line .... *Ucides*
  B′. Inner edges of ischium and merus of outer maxillipeds forming a reëntering angle .... *Cardisoma*

Genus GECARCINUS Leach.

Gecarcinus Leach, Edin. Encyc., VII, 430, 1814.

Carapace oval, not high, but much swollen laterally; lateral margin not distinctly marked. Front very strongly recurved downward. Orbits deep, oval, and without a notch on the external margin. Inner antennæ almost entirely concealed under the front. Buccal cavity nearly circular. External maxillipeds very wide, with a wide space between them; the merus as large as the ischium, and covers entirely the small, two-jointed palpus which is inserted on its inner face. Margins of feet armed with spiniform teeth.

Gecarcinus lateralis (Freminville).

Ocypoda lateralis Freminville, Ann. Sci. Nat. (2), III, 224, 1835.
Gecarcinus lateralis Guérin, Icon. Règne Anim., pl. V, f. 1.

Carapace four-fifths as long as wide. Median and cervical sutures deep. Lateral border with a few spinules near orbit. Lower margin of orbit denticulate. Inner border of merus of outer maxillipeds without a distinct notch. Chelipeds very unequal; carpus without teeth on its inner margin. Fingers gaping. Dactyli of ambulatory legs armed with four rows of spines.

Length of male, Vieques, 40.3 mm.; width, 50 mm.; width between outer orbital angles, 25.6 mm.; width of front near lower margin, 10.5 mm.

Bahamas; Florida Keys to United States of Colombia and Venezuela; Bermudas. Porto Rico: Arroyo, under logs on land 20 feet above high water; Caballo Blanco Reef, Vieques; Mayaguez (Gundlach).

Genus UCIDES Rathbun.

Uca Latreille, Nouv. Dict. Hist. Nat., XXXV, 96, 1819 (not *Uca* Leach, 1814).
Ucides Rathbun, Proc. Biol. Soc. Wash., XI, 154, June 9, 1897.
Oedipleura Ortmann, Zool. Jahrb., Syst., X, 334, 1897.

Carapace oval and very high. Front very narrow, strongly inclined and almost semicircular. Orbits rather large and open outside below the external angle. Buccal cavity of rhomboidal form; merus and ischium of external maxillipeds quadrilateral, almost the same size, with a straight inner border. Palpus articulated at outer angle of merus and applied against its anterior border. Dactyli of ambulatory legs not spinous.

Ucides cordatus (Linnæus). Plate 1.

Cancer cordatus Linnæus, Amœn. Acad., VI, 414, 1763.
Ucides cordatus Rathbun, Ann. Inst. Jamaica, I, 25, 1897, and synonymy.

Carapace of male three-fourths as long as broad. Lateral margin a line of indistinct granules. Chelipeds very unequal, the larger one very long and strong, both armed on inner surface with strong spines, especially along margins; fingers spoon-shaped at tips, those of large chela widely gaping. Ambulatory legs densely fringed with long hair. Female considerably narrower than male; lateral marginal line very prominent; chelipeds short and subequal; ambulatory legs sparsely hairy.

Length of male, Rio de Janeiro, 54 mm.; width, 70 mm.; width between outer orbital angles, 43.4 mm. Length of female, San Juan, 32 mm.; width, 40.5 mm.; width between outer orbital angles, 28.5 mm.

Porto Rico: San Juan; Rio Bayamon, above Palo Seco; Porto Rico (Gundlach). Cuba; Jamaica; St. Thomas; Surinam; Brazil.

Genus CARDISOMA Latreille.

Cardisoma Latreille, Encyc. Méth., Hist. Nat., Insectes, X, 685, 1825.

Carapace very high, squarish. Front very wide and almost straight. Buccal cavity in the form of an elongated square. The ischium of the external maxillipeds is narrow anteriorly, and the merus, a little shorter than the ischium, widens from behind forward in such a way as to form between the maxillipeds a rhomboidal space; the merus is almost heart-shaped, is cut on its anterior border, and has the palpus inserted at its external angle; the palpus is exposed to view. Dactyli of ambulatory legs very spinous.

Cardisoma guanhumi Latreille.

Cardisoma guanhumi Latreille, Encyc. Méth., Hist. Nat., Insectes, x, 685, 1825.

Carapace of male very large, about four-fifths as long as wide, much swollen outside lateral margin, which is either faintly or distinctly indicated; a notch behind outer orbital angle. Front wider than orbit, bent down, with a broad median sinus on its margin. The chelipeds are extremely unequal, the larger one very powerful, tuberculate along margins of both chelæ; fingers of large chela widely gaping. Ambulatory legs spinous. The chelipeds of the female are also unequal, but much less so than in the male.

Length of male from San Juan market, 77 mm.; width, 94 mm.; width between outer orbital angles, 68 mm.; posterior width of front, 28 mm.

Bahamas; Florida Keys to Brazil; Bermudas (Rankin). Porto Rico: Collected by the Fish Commission at Cataño; San Juan market; Rio Bayamon, above Palo Seco. Porto Rico (Gundlach).

Its common name in Porto Rico is "Juey" (San Juan market).

Family GRAPSIDÆ Milne Edwards, 1837.

Carapace depressed or moderately convex, more or less quadrilateral, with the lateral margins straight or slightly arcuate. Front never very narrow, in general decidedly broad. Orbits and eyestalks of moderate size. Third maxillipeds with the palpus articulated at the apex or at the front outer angle of the merus. Chelipeds in adult male usually subequal, moderately developed. In the walking legs the seventh joint is styliform, compressed, and either smooth or spiniferous. The pleon at the base usually covers the whole width of the sternum between the last pair of legs.

Key to the Porto Rican genera of the family Grapsidæ.

A. Antennæ covered by the front.
  B. External maxillipeds without a piliferous ridge.
    C. Antennæ excluded from the orbit .... *Goniopsis*
    C′. Antennæ entering the orbit.
      D. Merus of maxillipeds longer than broad.
        E. Fingers spoon-shaped at tips .... *Grapsus*
        E′. Fingers acute .... *Geograpsus*
      D′. Merus of maxillipeds as broad as long .... *Pachygrapsus*
  B′. External maxillipeds with a piliferous ridge.
    C. Lateral margins straight.
      D. Carapace elongate, very narrow behind .... *Aratus*
      D′. Carapace transverse, usually quadrate .... *Sesarma*
    C′. Lateral margins arcuate and entire .... *Cyclograpsus*
A′. Antennæ visible from above.
  B. Merus of maxillipeds large, as broad as ischium .... *Plagusia*
  B′. Merus of maxillipeds small, much narrower than ischium .... *Percnon*

Genus GONIOPSIS de Haan.

Goniopsis de Haan, Fauna Japon., p. 5, 1833; p. 33, 1835.

Carapace flat; front vertical, over half as wide as carapace; sides straight, with one tooth. Suborbital lobe broad, reaching the front and excluding the antenna from the orbit. External maxillipeds narrow; merus and ischium of equal length.

Goniopsis cruentata (Latreille). *Mangrove Crab.* Plate 1.

Grapsus cruentatus Latreille, Hist. Nat. Crust., vi, 70, 1803.
Grapsus (*Goniopsis*) *cruentatus* de Haan, Fauna Japon., 33, 1835.

Front granulate, suprafrontal lobes four, margins crenulate, orbits entire above, two notches below on outer half. Carapace with oblique ridges on branchial regions, transverse ridges anteriorly. Anterior margin of merus of chelipeds expanded, dentate, the upper and lower margins with spiniform tubercles, as is also the upper margin of carpus. Hands with spiniform tubercles above and below, the middle of the outer surface smooth, the inner surface with scattered prominent tubercles. Thumb and finger subexcavate, the latter spinose above. Ambulatory feet compressed and armed with stiff black bristles. Posterior angle of merus of last pair rounded, in the other feet dentate.

Dimensions of male: Length, 48 mm.; width, 57.5 mm.; width of front, 28.6 mm.

Bahamas and Florida Keys to Rio de Janeiro; Pensacola in fish stomach; Bermudas; West Africa; west coast of Nicaragua (Kingsley). Porto Rico: Rio Bayamon, above Palo Seco; Hucares; Ensenada Honda, Culebra; San Juan (G. M. Gray coll.); Mayaguez (Gundlach). Also taken at Nassau, Bahamas, by the *Fish Hawk*.

Very abundant on the mangrove roots and a conspicuous object with its dark reddish-brown body and almost white palms.

Genus GRAPSUS Lamarck.

Grapsus Lamarck, Sys. Anim. sans Vert., 150, 1801.

Sides arcuate, with one tooth behind the orbital angle. Front narrow, deflexed. Antennæ entering the orbit. External maxillipeds narrow, widely gaping; merus oblong. Fingers of chelipeds excavate.

Grapsus grapsus (Linnæus).

Cancer grapsus Linnæus, Sys. Nat., 10th ed., I, 630, 1758.
Cancer (Grapsus) grapsus Latreille, Règne Anim. Cuvier, III, 16, 1817.

Carapace depressed, transversely plicate, folds anteriorly broken up into squamiform tubercles. Frontal crest four-lobed, median lobes the larger, their margins subtuberculate. Frontal margin crenulate, regularly arcuate. Lateral margin very arcuate. Inferior border of orbit with a deep fissure. Inner border of ischium and merus of cheliped spinous, lower margin of merus spino-tuberculate, outer surface plicate. Carpus with distant tubercles, its inner margin with a laminate spine. Hand above tuberculate and with a large distal tooth, externally with longitudinal ridges, below with oblique folds. On the inner surface the tubercles and folds are less prominent. Fingers of moderate length, tips excavate. Ambulatory feet compressed, last two joints spinose.

Dimensions of male: Length, 57 mm.; width, 65.5 mm.; width between outer orbital angles, 45.5 mm.; width of front, 24.5 mm.

Porto Rico: San Juan; Aguadilla; Boqueron Bay; Guanica Bay; reefs at Ponce; Arroyo; Hucares; Caballo Blanco Reef, Vieques; Quebradillas (Gundlach). Distributed throughout the Tropics.

Genus GEOGRAPSUS Stimpson.

Geograpsus Stimpson, Proc. Acad. Nat. Sci. Phila., X, 101, 1858.

Carapace depressed, sides curved anteriorly, straight behind, one tooth behind the angle of the orbit. Front less than one-half width of carapace, strongly deflexed. Internal suborbital lobe of moderate size, reaching the front. Antennæ entering the orbit. Outer maxillipeds narrow, merus scarcely shorter than ischium. Fingers of chelipeds acute.

Geograpsus lividus (Milne Edwards). *Land Crab.*

Grapsus lividus Milne Edwards, Hist. Nat. Crust., II, 85, 1837.
Geograpsus lividus Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 230, 1860.

Carapace much broader than long, depressed. Plications nearly transverse. Frontal lobes prominent, front deflexed, its margin nearly straight. Sides of carapace slightly arcuate. Orbit with a deep fissure below. Merus of chelipeds with transverse rugæ above and below, its inner margin expanded, proximally denticulate, distally with larger teeth. Carpus granulate, a short spine on the inner margin. Hand and dactylus tuberculate above, externally and below with short, oblique rugæ; fingers acute. Distal angle of meral joints of last pair of ambulatory feet rounded.

Dimensions of male: Length, 24.8 mm.; width, 30.2 mm.; width between outer orbital angles, 24.5 mm.; width of front below, 12 mm.

Florida Keys to Sabanilla, United States of Colombia; Bermudas (Verrill); Lower California to Chile; James Island, Galapagos. Porto Rico: Puerto Real; Ponce, on reefs; Hucares; Ensenada Honda, Culebra; Vieques (Dr. L. Stejneger, March 28, 1900).

Genus PACHYGRAPSUS Randall.

Pachygrapsus Randall, Jour. Acad. Nat. Sci. Phila., VIII, 127, 1839.

Carapace somewhat narrowed behind and with transverse striæ. Sides entire, or with one or two teeth. Front more than half the width of the carapace, moderately deflexed. Inner suborbital lobe small, allowing the antennæ to enter the orbit. External maxillipeds widely gaping; merus as broad as long.

Key to the Porto Rican species of the genus Pachygrapsus.

A. Superior margin of palm and movable finger entire........ ....*transversus*
A′. Superior margin of palm and movable finger denticulate ....*gracilis*

Pachygrapsus transversus Gibbes.

Grapsus transversus Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 181, 1850.
Pachygrapsus transversus Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 182, 1850.

Carapace depressed, shining, with transverse plicæ, oblique on the branchial region. Sides strongly converging posteriorly, slightly arcuate, with one tooth behind the orbital angle. Frontal lobes prominent, front sinuous. Merus of chelipeds with transverse rugæ, inner margin denticulate; carpus rugose, with an inner rounded tubercle. Hand minutely granulate, a longitudinal ridge on lower outer surface, margins rounded; dactylus with upper margin smooth. Postero-distal angle of the merus of the ambulatory legs dentate.

Dimensions of male: Length, 11.3 mm.; width at lateral tooth, 14.8 mm.; width at outer orbital angles, 14.5 mm.; width of front below, 8.3 mm.

Bahamas and Florida Keys to Rio de Janeiro; Bermudas; West Africa; Oriental region; Galapagos Islands; California to Peru. Porto Rico: San Juan, on beach; Mayaguez, on reefs; Puerto Real; Boqueron Bay; Guanica Bay; Guanica, on reefs; Ponce, on reefs; Arroyo; Caballo Blanco Reef, Vieques; Ensenada Honda, Culebra; Fajardo.

Pachygrapsus gracilis (Saussure).

Metopograpsus gracilis Saussure, Mém. Soc. Phys. Hist. Nat. Genève, XIV, 443, pl. II, f. 15, 1858.
Pachygrapsus gracilis Stimpson, Ann. Lyc. Nat. Hist. N. Y., X, 113, 1871.

Carapace much as in *P. transversus*, but with no folds on the cardiac region; lateral margins nearly straight, with one tooth. Frontal lobes nearly obsolete; front very broad, nearly horizontal, regularly arcuate and minutely crenulate. Hand and dactylus of cheliped spined or toothed above.

Dimensions of male: Length, 12 mm.; width at lateral tooth, 16 mm.; width at outer orbital angles, 15.5 mm.; width of front, 10 mm.

Bahamas; Florida; West Indies; Yucatan; Sabanilla, United States of Colombia; Rio Parahyba do Norte, Brazil; Bermudas. Porto Rico: Boqueron Bay (*Fish Hawk*); San Juan (G. M. Gray coll.). Also taken at Nassau, Bahamas, by the Fish Commission party.

Genus ARATUS Milne Edwards.

Aratus Milne Edwards, Ann. Sci. Nat. (3), XX, 187 (153), 1853.

Carapace trapezoidal, elongate, narrow behind; sides straight, entire. Front deflexed, very broad. External maxilliped with an oblique piliferous ridge crossing the merus and ischium; merus elongate; apex rounded. Ambulatory feet compressed, the dactyli very short.

Aratus pisonii Milne Edwards. *Mangrove Crab.*

Sesarma pisonii Milne Edwards, Hist. Nat. Crust., II, 76, pl. XIX, figs. 4 and 5, 1837.
Aratus pisoni Milne Edwards, Ann. Sci. Nat. (3), XX, 187 (153), 1853.

Carapace tranversely arcuate, branchial regions obliquely plicate. Regions well marked. Front vertical, its margin two-lobed. Merus of chelipeds triquetral, margins denticulate, inner margin slightly expanded distally. Carpus externally granulate. Hands everywhere granulate, the outer surface of palm and fingers ornamented with pencils of stiff black hairs.

Dimensions of male: Length, 23 mm.; width, 24.5 mm.; width of front, 16.7 mm.

Florida to Brazil; west coast of Nicaragua; Ecuador. Porto Rico: Mayaguez, in fresh water; Boqueron Bay; Puerto Real; Hucares, where it was seen climbing mangrove trees. Also taken at Nassau, Bahamas. San Juan, Porto Rico (Gundlach); also collected by G. M. Gray.

Genus SESARMA Say.

Sesarma Say, Jour. Phila. Acad. Sci., I, 76, 1817.

Carapace thick, quadrate; lateral margins straight, and entire or toothed. External maxillipeds with an oblique piliferous ridge crossing ischium and merus; the merus elongate, its apex rounded. Antennæ entering the orbit.

Key to the Porto Rican subgenera of the genus Sesarma.

A. Lateral margins with a tooth behind the orbital angle...*Sesarma*
A′. Lateral margins entire...*Holometopus*

Subgenus SESARMA Say.

Lateral margins of carapace with a tooth behind orbital angle. No pectinated ridges on upper surface of the palm.

Sesarma (Sesarma) curaçaoense de Man.

Sesarma curaçaoensis de Man, Notes Leyden Mus., XIV, 257, pl. X, f. 6, 1892.

Carapace wide; superior frontal lobes faintly marked; lateral teeth prominent and separated by a deep notch. Surface finely punctate and with scattered bunches of fine pubescence. Eyes reaching the extremity of the outer angle of the orbit. Propodus of cheliped in male very short and deep; dactylus strongly arched.

Dimensions of male: Length, 12.2 mm.; anterior width, 15.1 mm.; posterior width, 14.9 mm.; superior frontal width, 8.9 mm.; length of propodus of cheliped, 12 mm.; greatest depth of same, 7.8 mm.

Curaçao; Jamaica; Cuba. One male was taken in Porto Rico, but is without indication of special locality.

Subgenus HOLOMETOPUS Milne Edwards.

Holometopus Milne Edwards, Ann. Sci. Nat. (3), XX, 187 (153), 1853.

Lateral margins of the carapace entire. No pectinated ridges on the upper surface of the palm.

Sesarma (Holometopus) ricordi Milne Edwards.

Sesarma ricordi Milne Edwards, Ann. Sci. Nat. (3), XX, 183 (149), 1853.

Carapace broader than long, and broader posteriorly than anteriorly. Granules of anterior and antero-lateral regions few and small, and scarcely visible to naked eye. Front about 3.5 times as wide across the superior lobes as it is high; sides concave. Appendages of first abdominal segment transversely arcuate and fringed with hair. Carpus of chelipeds rugose. Hands smooth to eye, showing numerous fine granules under the lens. Ambulatory legs long and slender, merus of third pair being 3 or more times as long as broad in adults, less than 3 times as long as broad in small specimens.

Dimensions of male: Length, 14.4 mm.; anterior width, 15.5 mm.; posterior width, 15.2 mm.; width of front on a level with the superior orbital lobes, 8.3 mm.

Florida Keys to Sabanilla and Trinidad; Bermudas (Verrill). Porto Rico: Puerto Real; Boqueron Bay; Hucares; Ensenada Honda, Culebra. It is probably this species which Gundlach reports from Bayamon as *Sesarma cinerea*.

Genus CYCLOGRAPSUS Milne Edwards.

Cyclograpsus Milne Edwards, Hist. Nat. Crust., II, 77, 1837.

Carapace anteriorly deflexed; sides arcuate, entire; front about half the width of carapace. Antennæ not excluded from orbit. Merus of external maxillipeds about as long as the ischium; its external angle well marked, the palpus articulating with the anterior margin; merus and ischium crossed by an oblique piliferous ridge.

Cyclograpsus integer Milne Edwards.

Cyclograpsus integer Milne Edwards, Hist. Nat. Crust., II, 79, 1837.

Carapace for the most part smooth and punctate; granulate near front and antero-lateral angle. Lateral margins marked by a raised granulate line. Inferior border of orbit separated from external angle by a deep cut; no postorbital furrow. Merus of chelipeds with a faint subterminal lobe on upper margin. Outer surface of merus and inner margin of carpus granulate. Otherwise the chelipeds are smooth and unarmed. Propodal and terminal joints of ambulatory legs spinous.

Dimensions of male: Length, 10 mm.; anterior width, 8.6 mm.; posterior width, 12.2 mm.; width of front below, 4.5 mm.

Florida; Bahamas; West Indies; Sabanilla, United States of Colombia; Brazil; Bermudas. Porto Rico: Beach at San Juan; reefs at Ponce; Ensenada Honda, Culebra; Hucares.

Genus PLAGUSIA Latreille.

Plagusia Latreille, Gen. Crust., I, 33, 1806.

Carapace much flattened and with numerous tubercles. Antennules exposed in deep longitudinal sinuses of the front and visible in a dorsal view. Outer maxillipeds with merus joint well developed, as wide as ischium. Merus joints of ambulatory legs spined near distal end. Male genital appendages of first pair without a terminal claw.

Plagusia depressa (Fabricius).

Cancer depressus Fabricius, Sys. Ent., 406, 1775.
Plagusia depressus Say, Jour. Phila. Acad. Sci., I, 100, 1817.

Carapace broader than long; surface covered with depressed tubercles margined with short setæ. A series of about six prominent acute tubercles arranged in an arc across front of gastric region. Lateral margins three-spined behind orbit. Frontal margin tuberculate between antennules, with two blunt teeth between antennule and orbit. Outer orbital spine strong. Terminal segment of the abdomen in male with sides distinctly convergent. Chelipeds with tuberculate crests above, fringed with setæ. The lobe above the bases of the second and third ambulatory legs broad and regularly dentate.

Male: Length, 38 mm.; width, 39.5 mm.; width between outer orbital angles, 24 mm.

Known from Charleston, S. C., to Brazil; from the Mediterranean to St. Helena and South Africa; Bermudas (Verrill). Porto Rico: Arroyo (*Fish Hawk*); San Juan (Gundlach).

Genus PERCNON Gistel.

Acanthopus de Haan, Fauna Japon., 5, 1833; 29, 1835. (Name preoccupied.)
Percnon Gistel, Naturg. Thierreichs, p. VIII, 1848.
Leiolophus Miers, Cat. Crust. New Zealand, 46, 1876.

Carapace remarkably flattened, with smooth naked ridges on its upper surface, but without numerous tubercles. Antennules exposed in deep longitudinal sinuses of the front and visible in a dorsal view. Outer maxillipeds with merus joint very small and much narrower than preceding joint. Merus joints of ambulatory legs with a series of spines on their upper margins. Male genital appendages of the first pair not twisted, with a terminal hook.

Percnon planissimum (Herbst).

Cancer planissimus Herbst, Natur. Krabben u. Krebse, III, pt. 4, p. 3, pl. LIX, f. 3, 1804.
Leiolophus planissimus Miers, Cat. Crust. New Zealand, p. 46, 1876.
Percnon planissimum Rathbun, Proc. U. S. Nat. Mus., XXII, 281, 1900.

Carapace suborbicular, longer than broad, antero-lateral margin with three teeth besides the orbital. Front with four spines between antennules, three spines between antennule and orbit. Merus and carpus of chelipeds spinous. Hands in male strong; palms compressed and considerably dilated, much broader than the wrist, not sulcated on upper margins. Greatest width of abdomen of male exceeding its length to base of last segment. Ambulatory legs with transverse bands of color.

Male: Length, 22 mm.; width, 20 mm.; width between outer orbital angles, 13.7 mm.

Playa de Ponce Reef, Porto Rico. Distributed throughout the West Indian region to Brazil; Bermudas (Verrill); Azores; west coast of Spain and Portugal; west and south Africa; Oriental region from Mauritius to Japan, and Sandwich Islands; Clarion Island, Mexico; Cape St. Lucas; Chile.

Family PINNOTHERIDÆ Milne Edwards, 1837.

Carapace often more or less membranaceous, antero-lateral margins entire or very slightly dentate. Front, orbits, and eye-stalks very small. Buccal frame usually arcuate anteriorly. Outer maxillipeds with the fourth joint well developed, and usually the third also, the fifth articulating usually at the apex or at front inner angle of the fourth. Chelipeds in adult male small or moderately developed. Walking legs slender, with the seventh joint styliform, unarmed. The pleon of the male in general does not cover the whole width of sternum between the last pair of legs.

Crabs of small size, living often in shells of bivalve mollusks, in or on the tests of Echini, and in tubes of worms.

Key to the Porto Rican genera of the family Pinnotheridæ.

A. Dactyli of ambulatory legs simple, acute.
  B. Third ambulatory leg very little, if any, longer than the other legs .... *Pinnotheres*
  B′. Third ambulatory leg longer and stronger than the others, usually considerably so........................... *Pinnixa*
A′. Dactyli of first, second, and third pairs of ambulatory legs bifurcate .... *Dissodactylus*

Genus PINNOTHERES Latreille.

Pinnotheres Latreille, Hist. Nat. Crust., III, 25, 1802.

Carapace smooth, subglobose, more or less membranaceous, very little wider than long. Orbits small, nearly circular. Front narrow, with the anterior margin nearly straight. Antennules obliquely transverse; merus large, usually curved, last joint of palp joined to inner margin of preceding one. Ambulatory legs not differing remarkably in length and of moderate length.

Key to the Porto Rican species of the genus Pinnotheres.

A. Dactylus of endognath cylindrical, about half as long as propodus... *ostrearius*
A′. Dactylus of endognath subspatulate, considerably more than half as long as propodus.......................... *guerini*

Pinnotheres ostrearius, sp. nov. *Oyster Crab.*

Carapace very thin and yielding, transversely oblong-orbicular, broad behind, about one-sixth broader than long; furrow on either side of gastric region rather deep; cardiac region less deeply outlined; surface smooth and shining. Front rounding downward, slightly projecting, margin truncate. Orbits circular, eyes partly visible in a dorsal view. Widest part of merus of maxilliped considerably behind distal extremity. Carpal joint oblong, and a little more than one-third the greatest width of merus; propodal joint about as long as carpal and a little narrower; last joint attached near proximal end of the inner margin of propodus, and very slender, cylindrical, and about one-half length of propodus. Chelipeds smooth; palm rapidly increasing in width from proximal to distal end; fingers cylindrical, half as long as palm, somewhat hairy, edges meeting and tips crossing when closed. First ambulatory leg stouter than the others; second pair the longest; first and third subequal: the fourth pair reaches about the middle of propodus of third pair.

Dimensions of female: Length, 7.2 mm.; width, 8.6 mm.

Type locality, Mayaguez, in an oyster from near Cabo Rojo, 2 females, one of which is ovigerous (Cat. No. 23767).

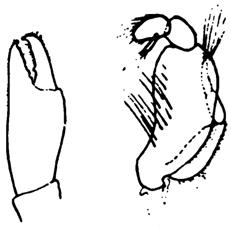

FIG. 3.—*Pinnotheres ostrearius*, female. (*a*) Chela, × 8. (*b*) Maxilliped, × 12.8.

This species is very close to *Pinnotheres ostreum* Say, which inhabits the oyster of the eastern United States; it differs, however, in its softer integument, less orbicular outline, less swollen hands, and, above all, in the form of the outer maxilliped; the last joint in *P. ostreum* is much smaller.

Pinnotheres guerini Milne Edwards.

Pinnotheres guérini Milne Edwards, Ann. Sci. Nat. (3), XX, 219 (185), pl. XI, f. 9, 1853.
Pinnateres guerini von Martens, Arch. f. Naturg., XXXVIII, 106, 1872.

Maxillipeds wide; palp very large, dactylus large and subspatulate. Hands smooth, short and punctate (Milne Edwards). Carapace nearly 1.5 times broader than long (von Martens).

Porto Rico, in oysters (Gundlach); Cuba (Milne Edwards, von Martens).

Genus PINNIXA White.

Pinnixa White, Ann. Mag. Nat. Hist., xviii, 177, 1846

Carapace much wider than long; integument usually firm. Front narrow, nearly transverse. Orbits broadly ovate or nearly circular, with a wide inner hiatus which is partly occupied by the basal antennal joints. Antennules transversely or obliquely plicated in wide fossettes which communicate with each other beneath the front. Eye-stalks very short. Epistome linear-transverse. Ischium of maxillipeds small, merus large, distal portion of outer margin convex; palp joined to summit of merus; third joint articulated on inner side of the preceding one near base. Chelipeds of moderate size; merus trigonous; carpus smooth; hand large, compressed. Second ambulatory legs larger than first; third pair largest of all; fourth pair much shorter than third and relatively stouter than first and second. Abdomen in both sexes 7-jointed and narrower at base than the width of last sternal segment.

Pinnixa minuta, sp. nov.

Carapace of male less than twice as wide as long; a line connecting the lateral angles is behind the gastro-cardiac suture; the middle portions of the lateral margins are subparallel to each other. The regions are separated by deep furrows, the gastric, cardiac, and branchial regions being separately convex; the cardiac region is less than twice as wide as long and without a crest; upper surface finely granulate, the antero-lateral margins coarsely granulate. Front truncate and non-projecting. Antennæ longer than the width of front. Merus of the maxillipeds longitudinal; propodus of palpus about 1.5 times as long as wide; dactylus spatulate. Chelipeds granulate; palm stout, 1.5 times as long as wide; the fingers are two-thirds as long as the palm and gape slightly. The ambulatory legs are margined with broad bands of spinuliform granules; first two pairs narrow, with very slender dactyls; third pair much larger, but similar; fourth pair the narrowest and slightly overreaches merus of third pair; its dactylus is shorter and relatively stouter. Sternum granulate along margins of segments. Abdomen oblong, with sixth and seventh segments narrowest; sixth shorter than third, fourth, or fifth, which are subequal; seventh transversely oblong, its distal margin gently arcuate. The surface shows a few granules. Surface of carapace, chelipeds, and legs pubescent.

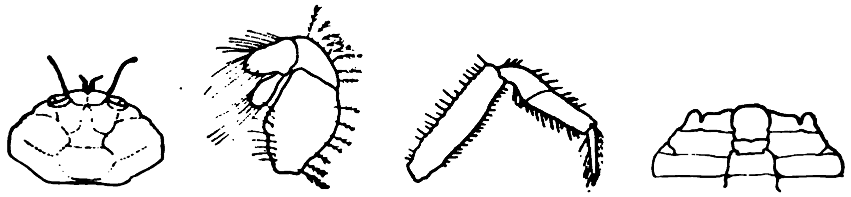

FIG. 4.—*Pinnixa minuta*, male. (*a*) Outline of carapace, × 10. (*b*) Maxilliped, much enlarged. (*c*) Third ambulatory leg. × 13.33. (*d*) Last three abdominal segments, × 13.33.

Dimensions of male: Length, 1.3 mm.; width, 2.3 mm.

Type locality, Mayaguez Harbor, 161 to 172 fathoms, station 6066; one male (Cat. No. 23768).

Genus DISSODACTYLUS Smith

Dissodactylus Smith, Trans. Conn. Acad. Sci., ii, 172, 1870.
Echinophilus Rathbun, Amer. Nat., xxxiv, 590, 1900

Carapace broader than long, pentagonal, broad behind, broadest at antero-lateral angles; surface smooth, not areolated; front narrow, horizontal, its margin continuous with arcuate antero-lateral margins. Eyes minute, superior margin of orbit slightly or not at all emarginate. Antennules transverse. Epistome usually very short, so that the labial border approaches very near to front, leaving only a narrow space, which is nearly filled by the antennulæ. The labial border is not interrupted in the middle by any projection or emargination and is continuous with lateral margin of buccal area. Palate without longitudinal ridges. Ischium and merus of maxillipeds coalescent; palpus composed of only two segments, of which the terminal one is large. Chelipeds of moderate size; fingers longitudinal. The ambulatory legs are small and differ little in length; dactyli of three anterior pairs bifurcate, those of posterior pair simple. In the male the sternum is flat and very broad, breadth between posterior legs much more than twice as great as breadth of basal segments of abdomen. Male abdomen narrow and only three-jointed, the first and second segments anchylosed, and the third, fourth, fifth, and sixth also united in one piece; in the female abdomen the segments are all free.

I recently established the genus *Echinophilus* on a cursory examination of specimens called *E. mellitæ*, supposing the palpus of the maxillipeds to consist of three joints instead of two; now having discovered my error, I place the type species, as well as the one here described, in the genus *Dissodactylus*.

Dissodactylus encopei, sp. nov.

The carapace is about 1.4 times as wide as long, the posterior width is but little less than the greatest width and much greater than the antero-lateral margins. The dorsal surface is naked and polished, is convex antero-posteriorly, and slightly so in the opposite direction. The antero-lateral margins are marked by a distinct line, which, after turning the lateral angle, runs up a little on the dorsal surface. The frontal and antero-lateral margins have also a fringe of fine hair. Posterior margin slightly concave at the middle, convex toward the sides. The inner distal angle of the terminal segment of maxilliped fits against the inner angle of the merus joint; this angle is thickened and densely clothed with hairs. Outer surface of chelipeds crossed by a few short oblique ridges, from which short appressed hairs proceed distally; margins on inner surface of segments also fringed with hair, while a longitudinal row of hairs is near the lower margin. Arm short, nearly as broad as long, and of about the same size as wrist; hand thick and subcylindrical; fingers nearly as long as palm and feebly dentate; they fit closely together, curve inward, and the tips are bent toward each other, and cross. Ambulatory legs short (their length less than width of carapace), and rather narrow and smooth, with hairy margins. Dactyli of first three pairs bifid at extremity. Dactyli of last pair simple, styliform, and acute. First segment of male abdomen narrower than second, being scarcely more than one-third the width of adjacent sternum; margins of second segment slightly convex; the segment tapers toward extremity; terminal segment equilaterally triangular and obtuse.

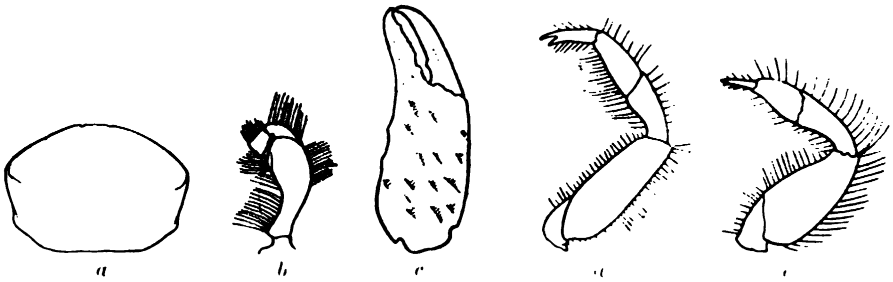

FIG. 5.—*Dissodactylus encopei*, male. (*a*) Outline of carapace, × 4. (*b*) Maxilliped, × 12.8. (*c*) Chela, × 10.66. (*d*) Fourth leg, × 10.66. (*e*) Fifth leg, × 10.66.

Length of male, 4.6 mm.; width, 6.6 mm. Length of female, 5 mm.; width, 7 mm.

Several specimens of this species were taken at Stann Creek, 38 miles south of Belize, British Honduras, by the Rev. W. A. Stanton, S. J.; they were attached to the lower surface of *Encope emarginata* (Leske); Cat. No. 23430, types.

A single young male, 27 mm. wide, was taken by the *Fish Hawk* in 11 fathoms, off Vieques, station 6084. It agrees with the types, except as to the ambulatory legs, which are relatively wider; a larger series is necessary to determine its identity with certainty.

This species has quite a different aspect from the type species, *D. nitidus*, being much wider, more convex, with the bifurcation of the dactyli less deep and less conspicuous. *D. mellitæ* is a convex species but somewhat narrower than *D. encopei*, being 1.33 broader than long; dactyli more deeply bifurcate. It is probable that the bifurcation of the dactyli is for the purpose of more ready attachment to foreign bodies, as two of the species are known to be commensal with sea-urchins.

Tribe CYCLOMETOPA or CANCROIDEA.

Carapace usually broader than long, regularly arched in front, and not rostrate. Epistome short and transverse; outer maxillipeds with the fifth joint articulated at the inner front angle of the fourth. Branchiæ nine; efferent channels opening at the sides of the endostome or palate. Genital organs of male inserted at bases of last pair of trunk legs.

Family POTAMONIDÆ Ortmann, 1896. Fresh-water Crabs.

Carapace more or less dilated at branchial regions. Third maxillipeds with palpus articulated at or near front inner angle of merus or at its apex. Terminal segments of walking legs usually spinuliferous. The verges of the male pass directly through the basal joint of the fifth pair.

Species fluviatile or living in damp earth away from the sea.

Genus EPILOBOCERA Stimpson.

Epilobocera Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 234, 1860.

Carapace transversely oval. Side margins tuberculate or dentate. Epigastric lobes and cervical suture present. Front inclined, generally bilobed, either straight or slightly arched, and with or without a superior margin. Inner suborbital lobe always present. Outer maxillipeds with merus of endognath broader than long, its outer margin either arcuate or angular. Exognath exceeding in length ischium of endognath. A tooth or spine in efferent branchial channel. Dactyli of ambulatory legs with numerous slender spines.

Epilobocera sinuatifrons (A. Milne Edwards).

Boscia sinuatifrons A. Milne Edwards, Ann. Soc. Entom. France (4), VI, 205, 1866.
Pseudothelphusa sinuatifrons Smith, Trans. Conn. Acad. Sci., II, 147, 1870.
Epilobocera sinuatifrons Rathbun, Proc. U. S. Nat. Mus., XXI, 529, 1898.

Carapace very broad; cervical sutures very deep; epigastric lobes prominent. Front narrow, with a superior crest, which projects beyond inferior and is nearly straight, emarginate at middle and tuberculate; lower margin sinuous, a little deeper at outer ends. Orbits about 1.5 times as wide as long, tuberculate, with a large outer notch. Antero-lateral margin with small, irregular, blunt teeth, the one behind cervical suture a little larger; margin also interrupted a little ways behind the orbit. Merus of outer maxilliped subquadrate, with an antero-external angle. Exognath slightly overlapping merus of endognath. Tooth of efferent branchial channel short and broad. Chelipeds very heavy and very unequal, especially in the male. Merus with upper margin rounded, rugose; inner margin with stout blunt teeth increasing in size distally; lower margin tuberculate. Carpus with an inner tooth, blunt and spiniform. Palm of larger hand swollen, of smaller with nearly parallel margins. Dactylus longer than upper margin of palm. Fingers stout, covered with large, dark granules, their prehensile edges not meeting when closed, and armed with stout and irregular teeth with white tips. Meri of ambulatory legs roughened above; carpal joints spinous distally; propodal joints spinous on margins; dactyli with five rows of large spines.

Dimensions of male: Length, 53.7 mm.; width, 94 mm.; width at outer orbital angles, 44.2 mm.; width of front at superior crest, 24 mm.; length of larger palm above, 36.5 mm.; width, 37 mm.; length of dactylus, 48.3 mm.

Porto Rico: Caguas, Rio Grande; San Juan market (*Buragina*). Also taken by Dr. L. Stejneger and Dr. C. W. Richmond at Plantation Catalina, El Yunque, 800 feet altitude, and by L. M. McCormick at Caves of Aguas Buenas. Also known from Santa Cruz Island.

This is probably the only species of the family occurring in Porto Rico, although Gundlach states that his specimens of *Epilobocera* were labeled "*E. cubensis*" by von Martens.

Local name *Buragina; Buruquena* (Gundlach).

Family PILUMNIDÆ Leach, 1819.

XANTHIDÆ Alcock, 1898.

Carapace commonly transverse and convex, with the antero-lateral margins arcuate, and armed with several lobes, teeth, or spines. The front is of moderate width, in general not projecting over the first antennæ and the bases of the second, the latter being seldom excluded from the inner hiatus of the orbits.

Key to the Porto Rican genera of the family Pilumnidæ.

A. The ridges that define the efferent branchial channels, if present, are usually low and are confined to the posterior part of endostome, never reaching to anterior boundary of buccal cavern.
  B. Fronto-orbital border less than half the greatest width of carapace.
    C. Antero-lateral borders of carapace sharp, crest-like; upper border at least of arms, and of fourth, fifth, and sixth segments of legs sharp and crest-like.................. *Platypodia*
    C′. Antero-lateral borders of carapace and upper borders of legs not crest-like.
      D. Antero-lateral borders entire up to a strong lateral epibranchial tooth.................. *Carpilius*
      D′. Antero-lateral borders divided into lobes or teeth.
        E. Carapace usually conspicuously lobulate, granulate, and hairy, chelipeds and legs also granulate and hairy. *Actæa*
        E′. Carapace, chelipeds, and legs not sharply granulate and hairy.
          F. Fingers sharp-pointed, not hollowed.................. *Cycloxanthops*
          F′. Fingers blunt-pointed, hollowed at tip.................. *Xanthodius*
  B′. Fronto-orbital border half or more than half the greatest width of the carapace. (True of American species of *Liomera*).
    C. Carapace transversely oval.
      D. Ambulatory legs with upper margins spiny or roughly granular.................. *Xanthias*
      D′. Ambulatory legs with upper margins smooth or nearly so.
        E. Antero-lateral teeth strong, greatly projecting. Carapace deeply areolated.................. *Leptodius*
        E′. Antero-lateral teeth small, little projecting. Carapace slightly or not at all areolated.
          F. Carapace crossed by transverse, broken, granulated lines.................. *Eurypanopeus*
          F′. Carapace without transverse granulated lines.
            G. Three suture lines near the outer angle of the orbit. Fingers somewhat hollowed at tip.................. *Liomera*
            G′. No suture lines near the outer angle of the orbit. Fingers acute, not hollowed at tip.................. *Eucratodes*
    C′. Carapace more or less hexagonal, or subquadrate.
      D. Ambulatory legs spinulous.
        E. Antero-lateral margin cut into five teeth or lobes, including the outer orbital.................. *Chlorodiella*
        E′. Antero-lateral margin with second and fifth normal spine or tooth reduced or wanting.................. *Micropanope*
      D′. Ambulatory legs not spinulous.
        E. Large cheliped very broad and heavy, more or less cristate above.................. *Glyptoplax*
        E′. Chelipeds of moderate size.
          F. Front very narrow and advanced. Postero-lateral margins strongly converging. Carapace hexagonal. *Hexapanopeus*
          F′. Front of moderate width. Postero-lateral margins not strongly converging. Carapace subquadrate. *Eupanopeus*
A′. The ridges that define the efferent branchial channels extend to anterior boundary of buccal cavern and are often very strong.
  B. Fronto-orbital border just about half or less than half greatest breadth of carapace, which is broad and transversely oval.
    C. The basal antennal joint does not nearly reach the front.................. *Menippe*
    C′. The basal antennal joint reaches the front.
      D. Anterior margin of merus of outer maxillipeds notched at orifice of efferent branchial channel.................. *Ozius*
      D′. Anterior margin of merus of outer maxillipeds not notched.................. *Eurytium*
  B′. Fronto-orbital border much more than half greatest breadth of carapace.
    C. Merus of external maxillipeds as long as or longer than broad.
      D. Fronto-orbital border about two-thirds greatest breadth of carapace.................. *Pilumnus*
      D′. Fronto-orbital border much more than two-thirds greatest breadth of carapace.
        E. Basal antennal joint as broad as long; arm scarcely projecting beyond lateral border of carapace.................. *Eriphia*
        E′. Basal antennal joint longer than broad; at least half of arm projects beyond carapace.................. *Melybia*
    C′. Merus of external maxillipeds about twice as broad as long.................. *Domecia*

Genus CARPILIUS Leach.

Carpilius Leach in Desmarest, Dict. Sci. Nat., XXVIII, 228, 1823.

Carapace broad, very convex in both directions, smooth (except for some coarse pitting inside the frontal and antero-lateral border), with no indication of regions; its antero-lateral borders strongly arched, thick, entire, smoothly molded; its postero-lateral borders strongly convergent, straight, with a prominent tubercle at angle of junction with antero-lateral. Front moderately broad (less than a third the greatest width of carapace), deflexed, three-lobed, the middle lobe prominent, the edges of all thickened. Orbital margins entire, the upper margin thickened and forming a well-marked blunt tooth at its junction with the antero-lateral margin. Eyes on short, thick stalks. Antennules folding obliquely; inter-antennulary septum broad. Basal joint of antennæ long, flat, running up into an oblique cleft between margin of front and infra-orbital plate; antennary flagellum very small, less than half diameter of orbit and lodged in said cleft. Merus of external maxillipeds with its anterior border very oblique. Chelipeds massive, smooth, unequal in both sexes; fingers bluntly pointed, those of larger cheliped with one or two molariform teeth, those of smaller cheliped with a blunt cutting edge. Legs smooth. Abdomen of male six-jointed, third and fourth somites fused with obliteration of sutures, fifth somite also immovably adherent to fourth.

Carpilius corallinus (Herbst).

Cancer corallinus Herbst, Natur. Krabben u. Krebse, I, 133, pl. V, f. 40, 1783.
Carpilius corallinus Leach in Desmarest, Consid. sur les Crust., 104, 1825.

Front almost vertically deflexed, median lobe entire in large specimens, bilobate in small ones, and separated from the lateral lobes on either side by a deep U-shaped sinus. Immovable finger of large cheliped with two teeth; movable finger with a single larger tooth. Legs compressed.

Color of carapace brick red, somewhat wine-colored, or coral red, covered with yellow spots. Legs veined with brown. Claws spotted. Fingers and nails brown. (A. Milne Edwards.)

Dimensions of male: Length, 108.2 mm.; width, 143.8 mm.; fronto-orbital width, 53 mm.; width of front, 37.2 mm. This is the largest West Indian species of crab.

Bahamas; West Indies; Goyanna Stone Reef, Brazil; Fernando Noronha (Pocock). Porto Rico: Ensenada Honda, Culebra; market at San Juan (Gundlach).

Genus LIOMERA Dana.

Liomera Dana, Am. Jour. Sci. (2), XII, 124, 1851.

Carapace extremely broad, strongly convex in both directions, transversely barrel-like, either smooth or with the regions very faintly indicated; its antero-lateral borders thick, either entire or divided into four broad shallow rounded lobes, of which the first two are almost coalescent; its postero-lateral borders very strongly convergent, straight or a little concave. Front from three-sevenths to less than a fourth the breadth of carapace, obliquely deflexed, grooved and notched on middle line. Orbits small, with the three suture lines near outer angle usually distinct; eye-stalks short and thick. The antennules fold nearly transversely. Basal antennal joint broad and short, merely touching the front; flagellum lodged in orbital hiatus. Anterior edge of merus of external maxillipeds a little oblique. Fingers of chelipeds somewhat hollowed at tip. Abdomen of male five-jointed, the third to fifth somites being fused.

Key to the Porto Rican species of the genus Liomera.

A. Large hand three times as wide as small one .... *longimana*
A′. Large hand twice as wide as small one .... *dispar*

Liomera longimana A. Milne Edwards.

Liomera longimana A. Milne Edwards, Nouv. Arch. Mus. Hist. Nat. Paris, I, 221, pl. XII, f. 7, 1865 (figure incorrect; hands represented of equal size); Crust. Rég. Mex., 240, pl. XLVI, f. 1, 1879.

Carapace about three-fifths as long as broad, thick, very convex, regions very faintly marked; antero-lateral margin showing four shallow lobes or teeth, the last two most distinct. Front a little less than a third the breadth of carapace, distinctly bilobed, and with a separate tooth at outer end below orbital angle; a transverse fringe of hair behind the lobes. Antennal flagellum longer than greatest diameter of orbit. Chelipeds extremely unequal in both sexes, smooth, conspicuously punctate; arm projecting beyond carapace; larger cheliped heavy, hands with subparallel margins; the smaller hand very slender, about one-third the width of larger. Fingers moderately gaping. Larger wrist nearly as broad as long, inner angle blunt; smaller wrist much longer than broad, without an inner angle. Legs compressed, almost smooth, hairy.

Male: Length, 7.3 mm.; width, 12.4 mm.; fronto-orbital width, 7.4 mm.; frontal width, 3.5 mm.

Florida Keys; West Indies; Vera Cruz, Mexico. Playa de Ponce Reef, Porto Rico.

Liomera dispar (Stimpson).

Chlorodius dispar Stimpson, Bull. Mus. Comp. Zool., II, 140, 1871.
Leptodius dispar A. Milne Edwards, Crust. Rég. Mex., 271, 1880.
Liomera dispar Rathbun, Ann. Inst. Jamaica, I, 13, 1897.

Carapace about three-fourths as long as broad, thick, convex, covered with a short pubescence easily rubbed off; regions not defined; an anterior median furrow, also a furrow separating the front from orbital angle; antero-lateral margins almost entire, three lobes faintly discernible. Front about one-third width of carapace, bimarginate, margin convex, median notch small, external angle not projecting. Eyes very short and stout. Antennal flagellum shorter than greatest diameter of orbit. Chelipeds less unequal than in *L. longimana*, the smaller hand not so slender, about half the width of larger. Smaller wrist similar in shape to larger and has an inner tooth. The black color of thumb runs back a little on the hand, forming a convex outline. Otherwise resembling *L. longimana*.

Male: Length, 2.9 mm.; width, 4 mm.; fronto-orbital width, 3.2 mm.; frontal width, 1.7 mm.

Cuba; Jamaica; Bermudas. From Arroyo, Porto Rico, on Lighthouse Reef, 1 male and 1 young female. Rare.

Genus PLATYPODIA Bell.

Platypodia Bell, Trans. Zool. Soc. London, I, 336, 1835.
Lophactæa A. Milne Edwards, Ann. Sci. Nat. (4), XVIII, 43, 1862.

Carapace moderately broad, convex in both directions, with regions generally well delimited and subdivided into lobes, and the surface generally (not always) granular; the antero-lateral borders have an independent crest-like edge, generally thin and sharp and distantly fissured; the postero-lateral borders rather concave. Front a little deflexed, about a fourth the greatest breadth of carapace in extent, grooved and emarginate in middle line. Orbits large, the three suture lines near outer angle distinct. Eyes on short thick stalks. Antennules folding obliquely transversely; inter-antennulary septum broad. Basal joint of antennæ short, touching front only; flagellum lodged in orbital hiatus. Merus of external maxillipeds with front edge a little oblique. Chelipeds equal in both sexes; fingers not hollowed at tip. Long joints of legs with sharp crest-like upper borders. Abdomen of the male five-jointed, the third to fifth somites being fused.

Platypodia spectabilis (Herbst).

Cancer spectabilis Herbst, Natur. Krabben u. Krebse, II, 153, pl. XXXVII, f. 5, 1794.
Cancer lobata Milne Edwards, Hist. Nat. Crust., I, 375, 1834.
Lophactæa lobata A. Milne Edwards, Nouv. Arch. Mus. Hist. Nat. Paris, I, 249, pl. XVI, figs. 3, 3*a*, 1865.
Platypodia spectabilis Rathbun, Ann. Inst. Jamaica, I, 13, 1897.

Surface lobulated, granulate. Antero-lateral crest extending very far back and continued by a small transverse crest on carapace in line with cardiac region; marginal crest cut by three narrow fissures; postero-lateral borders concave. Front deflexed, presenting two oblique truncate lobes in a dorsal view. In a front view these lobes are concave. Hands short, compressed, surmounted by a sharp, entire crest; outer surface covered with granules, irregularly placed on upper portion, but forming three or four longitudinal lines on lower part. Fingers pointed, channeled, their prehensile borders denticulate, also a broad lobe at base of immovable finger. Ambulatory legs short, compressed; nails very sharp. Suture lines faintly visible between the third, fourth, and fifth abdominal segments in the male.

Color, chocolate brown, with some yellow spots bordered with blue and black; similar spots on chelipeds. Legs red, with tricolored bands of yellow, blue, and black. Eggs reddish yellow. (A. Milne Edwards.)

Length of female, 13 mm.; width, 19.3 mm.; fronto-orbital width, 9 mm.; width of front, 5 mm.

Gulf of Mexico; Florida Keys; West Indies; Bermudas; Fernando Noronha (Pocock). Porto Rico: Puerto Real; Guanica Bay; Culebra.

Genus LEPTODIUS A. Milne Edwards.

Leptodius A. Milne Edwards, Ann. Sci. Nat. (4), XX, 284, 1863.

Carapace broad, suboval, moderately convex anteriorly, flat in posterior half; regions well delimited and fairly well lobulated in the anterior two-thirds, but not posteriorly. Antero-lateral borders arched, very long, not very thick, cut into five well-developed teeth, including the orbital angle; postero-lateral borders moderately convergent, not concave. Fronto-orbital border more than half the greatest width of carapace; front a fourth or more than a fourth the greatest width of carapace. Front little deflexed, rather prominently sublaminar, notched in middle line, separated from supra-orbital margin by a notch. Orbital margin with two suture lines above and one more distinct just below outer angle; usually a prominent tooth at inner angle of lower edge of orbit. Eyes on short thick stalks. Basal antennal joint short, meeting the front at inner angle of flagellum, which is about as long as orbit and is lodged in orbital hiatus. Anterior edge of merus of external maxillipeds nearly transverse, with commonly a small tooth near the antero-internal angle. Chelipeds unequal in both sexes; fingers spoon-shaped, or hollowed out at the tips. Legs compressed, the upper edges rather sharp. Abdomen of male five-jointed, the third to fifth somites fused.

Leptodius floridanus (Gibbes).

Chlorodius floridanus Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 175, 1850.
Leptodius floridanus A. Milne Edwards, Crust. Rég. Mex., 268, pl. XLIX, f. 2, 1880.

Lobules of carapace flattened, crossed by small transverse lines a little granulous or punctate, and separated by shallow grooves. Frontal lobes truncate and with a transverse groove. First three antero-lateral teeth obtuse or subacute, last two pointed. Merus of chelipeds short, not surpassing carapace; wrist and upper portion of hand rugose; the fingers touch only at their extremities; there is a tuft of hairs in the hollow. Legs hairy on margin. Color variable; sometimes a grayish green, sometimes yellow with red spots. Fingers black. (A. Milne Edwards.)

Length of male, 20.2 mm.; width, 31 mm.; fronto-orbital width, 17 mm.; frontal width, 7.9 mm.

Bahamas; Florida Reefs to Brazil; Bermudas. Porto Rico: Reefs at Guanica; Ponce; Playa de Ponce Reef; Arroyo; Caballo Blanco Reef, Vieques; Ensenada Honda, Culebra; San Juan (G. M. Gray).

Genus XANTHODIUS Stimpson.

Xanthodius Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 52, 1859.

Carapace very broad, oval, very convex anteriorly, flat in posterior half; the regions deeply limited, and deeply lobulated in anterior two-thirds. Antero-lateral borders arched, longer than in *Leptodius*, thick, cut into four rounded lobes or thickened, blunt, little-projecting teeth, exclusive of orbital angle, which is inconspicuous; postero-lateral borders nearly straight. Fronto-orbital border less than half the greatest width of carapace; front about a fourth the greatest width of carapace. Front more deflexed, but less prominent than in *Leptodius*; otherwise similar. Orbits very small; the two upper suture lines very faint; tooth at inner angle of lower edge not prominent. Eye-stalks short and thick. Inner orbital hiatus narrow, the antennal flagellum lodged in it. Merus of outer maxillipeds considerably broader than long. Chelipeds unequal in both sexes; surface eroded in reticulating lines; fingers spoon-shaped. Legs short, compressed. In the abdomen of male the third to fifth segments are fused.

Xanthodius parvulus (Fabricius).

Cancer parvulus Fabricius, Ent. Sys. auct. et emend., II, 451, 1793.
Chlorodius americanus Saussure, Mém. Soc. Phys. Hist. Nat. Genève, XIV, 430, pl. I, f. 5, 1858.
Leptodius americanus A. Milne Edwards, Crust. Rég. Mex., 269, 1880.
Xanthodius parvulus Rathbun, Ann. Inst. Jamaica, I, 15, 1897.

Lobules of carapace prominent and roughened with punctæ. Outer orbital angle small and inconspicuous; there are, besides, four blunt teeth; posterior marginal line of last tooth continued halt way back on postero-lateral margin. Front bimarginate, lobes of upper margin truncate, of lower concave. Arm of chelipeds scarcely exceeding carapace; wrist and hand rugose above and with some irregular depressions. Legs very finely granulate and slightly hairy.

Length of male, 15 mm.; width, 24.5 mm.; fronto-orbital width, 11.4 mm.; frontal width, 6 mm.

Bahamas; Florida Reefs; West Indies; Curaçao; Fernando Noronha (Pocock); Bermudas (Verrill). Ponce, Porto Rico.

Genus CYCLOXANTHOPS Rathbun.

Cycloxanthus A. Milne Edwards, Ann. Sci. Nat. (4), XX, 278, 1863.
Cycloxanthops Rathbun, Proc. Biol. Soc. Washington, XI, 164, 1897.

Carapace broad; front horizontal, prominent, and divided by a median fissure into two lamellar lobes, and separated from the internal orbital angles by a deepish notch. Orbits small; two fissures in the supra-orbital margin; external orbital angles inconspicuous, continuous with the antero-lateral borders. Antero-lateral borders very long, strongly curved, extending far backwards. Basal antennal joint short, but touching the front at its inner angle; flagellum inserted in orbital hiatus. Merus of the external maxillipeds subquadrilateral. Fingers sharp-pointed, not hollowed. The abdomen of male consists of five movable pieces.

Cycloxanthops denticulatus (White).

Xantho denticulatus White, Ann. Mag. Nat. Hist. (2), II, 285, 1848. A. Milne Edwards, Crust. Rég. Mex., 252, pl. XLV, f. 2, 1879.
Cycloxanthops denticulatus Rathbun, Ann. Inst. Jamaica, I, 14, 1897.

Width of carapace about 1.5 times length; regions well marked; surface punctate and pitted; the anterior portion lobulate, the lobules rugose. Antero-lateral borders having eight or ten small tuberculiform teeth. Front feebly divided into two lobes, nearly straight and with a tuberculiform tooth at the outer angle. Pterygostomian regions and merus of the outer maxillipeds granulose and rugose. Chelipeds strong, unequal, their upper surface rugose and eroded. Wrist with two tubercles at inner angle. Fingers strong, pointed, gaping in large cheliped.

Color, light purplish red, bright red, or orange red; fingers black.

Dimensions of male: Length, 14.5 mm.; width, 22.8 mm.; fronto-orbital width, 9.5 mm.; frontal width, 5 mm. Greatest width at antepenult tooth of lateral margin.

Bahamas; Florida Keys to Brazil; Bermudas. Porto Rico: Caballo Blanco Reef, Vieques; Hucares; Fajardo; San Juan (Gundlach).

Genus EUPANOPEUS Rathbun. Mud Crabs.

Panopeus Milne Edwards, Hist. Nat. Crust., I, 403, 1834. (Name preoccupied.)
Eupanopeus Rathbun, Bull. Labor. Nat. Hist. State Univ. Iowa, IV, 273, 1898.

Carapace of moderate width, length two-thirds to three-fourths the width, moderately convex, the regions fairly well delimited, crossed by broken transverse lines on anterior half. Antero-lateral borders horizontal or slightly upturned, shorter than postero-lateral, arcuate, tending to subquadrate, cut into five teeth, including orbital angle, which is more or less fused with the next tooth; the third, fourth, and fifth are usually well-marked and distinctly dentiform; outer margin of all the teeth sublaminar; postero-lateral borders moderately convergent, straight. Fronto-orbital border more than half the greatest width of carapace. Front between a third and a fourth the greatest width of carapace. Front horizontal or slightly deflexed, laminar, with a median notch, and two sinuous lobes, separated from the more elevated inner angle of orbit by a notch. Orbital margin with two small but distinct V-shaped notches above, continued backward by closed fissures, and a broad notch below outer angle. A prominent tooth at lower inner angle. Orbits transversely oblong, not tightly filled by the eyes. Inner portion of anterior margin of basal joint touches the front; outer angle of joint is prolonged into the broad orbital hiatus, but does not exclude flagellum from orbit. Merus of outer maxillipeds transverse, its anterior margin more or less sinuous. Chelipeds unequal in both sexes; the merus has a superior subterminal tooth; the carpus a tooth at the inner angle; fingers acute; movable finger of large cheliped with large basal tooth. Legs rather thick, compressed. Abdomen of male 5-segmented.

Key to the Porto Rican species of the genus Eupanopeus.

A. A distinct groove along anterior margin of carpus of cheliped.
  B. Front grooved. Third segment of abdomen of male not reaching coxal joints of fifth pair of feet....... *bermudensis*
  B′. Front not grooved. Third segment of abdomen of male reaching the coxal joints.
    C. Second antero-lateral tooth broad, lobiform.......... *occidentalis*
    C′. Second antero-lateral tooth narrow, tuberculiform .... *harttii*
A′. Carpal groove wanting or very indistinct.
  B. Width of carapace about 1.5 times length .... *herbstii*
  B′. Width of carapace about 1.3 times length.......... *americanus*

Eupanopeus herbstii (Milne Edwards).

Panopeus herbstii Milne Edwards, Hist. Nat. Crust., I, 403, 1834; Benedict & Rathbun, Proc. U. S. Nat. Mus., XIV, 358, pl. XIX, figs. 1 and 2, pl. XXIII, figs. 10–12, 1891.
Eupanopeus herbstii Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 273, 1898.

Carapace nearly or quite 1.5 times as wide as long. Regions well marked, convexity variable, surface coarsely granulate. First (or orbital) tooth of lateral margin triangular, blunt, little prominent; second tooth separated from first by a shallow rounded sinus, and larger and nearly as advanced as first, either blunt-pointed and with arcuate outer margin, or lobiform; third and fourth teeth still larger, prominent, with arcuate outer margins and acute tips, the third directed obliquely inward, the fourth forward or slightly inward; fifth tooth shorter, with acute tip and straight outer margin; a transverse ridge continued inward from its anterior margin. Front about two-sevenths the greatest width of carapace; middle portion of margin advanced only a little beyond outer angles. Chelipeds heavy, granulate; carpus without a groove parallel to distal margin. Dark color of thumb in large chela continued more or less on palm. Third segment of abdomen of male reaching coxæ of fifth pair of feet; terminal segment oblong, rounded at end.

A very large specimen measures 40 mm. long by 62 mm. wide; one of medium size, a female, is 28 mm. long, 40.6 mm. wide; fronto-orbital width, 23.2 mm.; width of front, 11.5 mm.

From Rhode Island to Brazil; Bermudas. Porto Rico: San Juan; Puerto Real, in a mangrove swamp; reefs at Ponce; Ensenada Honda, Culebra; San Juan and Mayaguez (Gundlach).

Eupanopeus occidentalis (Saussure).

Panopeus occidentalis Saussure, Rev. Mag. Zool. (2), IX, 502, 1857; Benedict & Rathbun, Proc. U. S. Nat. Mus., XIV, 360, pl. XX, f. 3, pl. XXIII, f. 14, 1891.
Eupanopeus occidentalis Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 273, 1898.

Differs from *E. herbstii* as follows: Gastric region more elevated, independently convex. Second tooth of lateral margin narrower and separated by a deeper sinus from first tooth; third to fifth teeth thicker, more prominent and more widely separated from each other, third tooth with anterior and exterior margins subequal. Front more advanced. Carpus of chelipeds with a groove parallel to distal margin. Dark color on thumb not continued on palm. Ambulatory legs a little longer and more slender. Abdomen of male wider, especially noticeable at penult segment.

In alcohol the chelipeds have a pinkish tinge not seen in *E. herbstii*.

Male: Length, 20 mm.; width, 27.2 mm.; fronto-orbital width, 16 mm.; width of front, 8.4 mm.

South Carolina to Pernambuco; Bermudas. Hucares, Porto Rico, 2 females, 1 with *Sacculina*.

Eupanopeus americanus (Saussure).

Panopeus americanus Saussure, Rev. Mag. Zool. (2), IX, 502, 1857; Mém. Soc. Phys. Genève, XIV, 432, pl. I, f. 8, 1857.
Panopeus areolatus Benedict & Rathbun, Proc. U. S. Nat. Mus., XIV, 361, pl. XXI, f. 3, 1891.
Eupanopeus americanus Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 273, 1898.

The carapace is narrower (width 1.3 times length) and flatter than in *E. herbstii*. The transverse rugæ are numerous. Sinus between first and second lateral teeth deepish; other teeth broad, rather blunt, third tetragonal, fourth with anterior margin at right angles to median line. Lobes of front with more oblique margins than in *E. herbstii*. Chelipeds similar to those of *E. herbstii*; a faint carpal groove may be present. Tooth at base of dactyl longer than in *E. herbstii*. Abdomen of male narrow, as in *E. herbstii*, but in shape resembling that of *E. occidentalis*.

Male: Length, 19.5 mm.; width, 26.3 mm.; fronto-orbital width, 15.5 mm.; width of front, 7.5 mm.

Bahamas to Brazil. Arroyo, Porto Rico; 1 male.

Eupanopeus bermudensis (Benedict & Rathbun).

Panopeus wurdemannii Benedict & Rathbun, Proc. U. S. N. M., XIV, 372, pl. XXIV, f. 6 and 7, 1891 (not *P. wurdemannii* Gibbes).
Panopeus bermudensis Benedict & Rathbun, Proc. U. S. N. M., XIV, 376, pl. XX, f. 2, pl. XXIV, figs. 14 and 15, 1891.
Eupanopeus bermudensis Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 273, 1898.

A smaller species than any other *Eupanopeus* taken at Porto Rico. The carapace more deeply areolated than any of above; a well-marked transverse line on branchial region on a level with last lateral sinus; also several shorter granulate ridges, and granules toward front and antero-lateral margins; otherwise smooth. Second tooth of lateral margin lobiform, separated from first by a rather shallow sinus; third and fourth large, with arcuate outer margins, third obtuse, fourth subacute; fifth narrow and pointed. The front has a thick, obliquely beveled edge, obscurely grooved, deflexed; in a dorsal view the lobes are nearly straight, oblique, but in a front view very sinuous. The carpus of chelipeds has a well-marked groove; fingers strongly bent down and usually light horn-colored with white tips; the color extends partially on palm also. Legs slender and delicate. Third segment of abdomen of male narrow, with rounding posterior corners, not reaching coxæ of fifth pair of feet.

Length of male, 5.8 mm.; width, 8 mm.; fronto-orbital width, 5.5 mm.; width of front, 2.8 mm.

Bermudas; Florida Keys to Brazil. Porto Rico: Mayaguez; Boqueron Bay; Guanica Bay; Arroyo, on Lighthouse Reef; Ensenada Honda, Culebra. Also taken at Nassau, Bahamas; 1 specimen having the genital appendages of a male, and an abdomen with seven segments, as in an immature female.

Eupanopeus harttii (Smith).

Panopeus harttii Smith, Proc. Boston Soc. Nat. Hist., XII, 280, 1869; Trans. Conn. Acad. Sci., II, pp. 5 and 34, pl. I, f. 5, 1869.
Eupanopeus harttii Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 273, 1898.

Carapace little convex, rugose, regions very distinctly marked. First and second antero-lateral teeth small, tuberculiform, separated by a U-shaped sinus. Remaining teeth rather narrow, thickened; tips tuberculiform. Front little advanced and with a small but distinct tooth at the orbital end. Carpus of chelipeds rugose and with a deep anterior groove. Color of fingers not continued to the palm. Abdomen of male reaching coxal joints.

Length of male, 8.6 mm.; width, 12.6 mm.; fronto-orbital width, 8.6 mm.; width of front, 4.1 mm. A small species, but larger than *E. bermudensis*.

Florida Keys to Brazil. Porto Rico: Boqueron; Mayaguez; Mayaguez Harbor.

Genus EURYPANOPEUS A. Milne Edwards.

Eurypanopeus A. Milne Edwards, Crust. Rég. Mex., 318, 1880.

Carapace rather broad, length about two-thirds the width, oval, depressed or slightly convex, the regions usually crossed by fine transverse broken granulated lines, but on the whole the carapace is smoother than in *Eupanopeus*. Antero-lateral borders horizontal or slightly upturned, as long as or slightly shorter than postero-lateral, arcuate, cut into five (including orbital) shallow teeth or lobes usually projecting little if at all beyond the general line of carapace. Second tooth low and rounded and rather closely fused with orbital. Fronto-orbital border more than half, and front a third or a little less than a third the greatest width of carapace. Front less advanced than in *Eupanopeus;* otherwise front and orbits much as in that genus. Orbital hiatus and basal joint of antenna narrower than in *Eupanopeus*. Chelipeds unequal in both sexes; the fingers may be acute or spoon-shaped or different on the two chelipeds of same species. Abdomen of male has usually the third, fourth, and fifth segments fused (only the fourth and fifth fused in *E. dissimilis*).

Eurypanopeus abbreviatus (Stimpson).

Xantho parvulus Milne Edwards, Hist. Nat. Crust., I, 395, 1834 (not *Cancer parvulus* Fabricius, 1793).
Panopeus abbreviatus Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 211, 1860.
Panopeus politus Smith, Trans. Conn. Acad. Sci., II, pp. 3 and 34, pl. I, f. 4, 1869.
Panopeus parvulus Benedict & Rathbun, Proc. U. S. Nat. Mus., XIV, 369, pl. XXI, f. 1, pl. XXIII, figs. 2 and 3, 1891.
Eurypanopeus parvulus A. Milne Edwards, Crust. Rég. Mex., 322, pl. LIX, f. 5, 1880.
Eurypanopeus abbreviatus A. Milne Edwards, Crust. Rég. Mex., 320, pl. LIX, f. 3, 1880. Rathbun, Ann. Inst. Jamaica, I, 19, 1897.

Carapace granulate on anterior third and along antero-lateral margins; an oblique granulated ridge on hepatic region, another parallel to it on the branchial region opposite last lateral sinus; a few transverse lines on gastric region. First and second antero-lateral teeth separated by a very shallow sinus; other teeth separated by shallow notches, the third with almost straight outer margin, the fourth slightly arcuate, fifth small and blunt. Front less than a third the width of carapace, little advanced, a narrow open median notch, lobes sinuous, more produced toward middle. Chelipeds finely granulate and pitted; fingers pointed; those of large cheliped gaping, dactylus with a large basal tooth. Dark color of pollex running from between bases of fingers obliquely to lower margin of manus. Third segment of abdomen of male extends to coxæ of last pair of legs.

Length of male, 11.7 mm.; width, 18.4 mm.; fronto-orbital width, 9.3 mm.; width of front, 4.9 mm.

Bahamas; Florida Keys to Brazil. Porto Rico: Ponce; Arroyo; Ensenada Honda, Culebra; Hucares.

Genus HEXAPANOPEUS Rathbun.

Hexapanopeus Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 273, 1898.

Carapace narrow (the length three-fourths or more of width), hexagonal, regions well delimited. Antero-lateral margin arcuate, about as long as postero-lateral, five-toothed, teeth prominent, orbital or first tooth partly fused with second, fourth tooth very prominent, fifth sometimes much smaller and almost postlateral in position. Postero-lateral margins strongly converging. Fronto-orbital border from half to three-fourths the greatest width of the carapace. Front from a fourth to about a third the greatest width of the carapace. Front advanced, with a median notch and oblique, sinuous or straight lobes, separated from inner orbital angle by a notch. Orbital margin with a well-marked lobe between sinuses above; otherwise the orbits are similar to those of *Eupanopeus*. Basal joint of antenna narrow, as in *Eurypanopeus*.

The Porto Rican species are small.

Distinguished from *Eurypanopeus* chiefly by the hexagonal, narrow carapace with produced front and very convergent postero-lateral margins.

Key to the Porto Rican species of the genus Hexapanopeus.

A. First and second antero-lateral teeth separated by a very shallow rounded sinus.
  B. Fifth antero-lateral tooth almost obsolete .... *caribbæus*
  B′. Fifth antero-lateral tooth well developed .... *hemphillii*
A′. First and second antero-lateral teeth separated by a deepish V-shaped sinus .... *quinquedentatus*

Hexapanopeus caribbæus (Stimpson).

Micropanope caribbæa Stimpson, Ann. Lyc. Nat. Hist. N. Y., x, 108, 1871.
Eurypanopeus caribbæus Rathbun, Ann. Inst. Jamaica, I, 20, 1897.
Hexapanopeus caribbæus Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 273, 1898.

Carapace with regions well marked; protogastric, branchial, and cardiac regions elevated; gastric and branchial crossed by prominent transverse granulated lines. A well-marked sinus between first and second lateral teeth, which are small and blunt; third and fourth large and prominent; third acute, fourth spiniform; carapace widest at fourth tooth, fifth minute. Fronto-orbital border two-thirds and front one-third the width of carapace. Front produced, median notch a well-marked V, lobes sinuous. Eyes large. Chelipeds finely granulate, a few tubercles on carpus, fingers elongate, strongly bent down, sharp, finely dentate (dactylus with a larger tooth at base), not gaping, the color of pollex continued extensively on palm. Ambulatory legs slender.

A small species. A male of good size measures 8.3 mm. long; 11.6 mm. wide; fronto-orbital width, 7.5 mm.; frontal width, 3.9 mm.

Jamaica; St. Thomas; Trinidad; Sabanilla, United States of Colombia. Porto Rico: Boqueron Bay; Hucares.

Hexapanopeus hemphillii (Benedict & Rathbun).

Panopeus hemphillii Benedict & Rathbun, Proc. U. S. Nat. Mus., XIV, 374, pl. XXIV, figs. 12 and 13, 1891.
Hexapanopeus hemphillii Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 273, 1898.

Carapace with regions distinctly indicated, epigastric lobes prominent, a few blunt transverse ridges, surface also finely granulate. First and second teeth small but well separated. Third to fifth teeth thickened, blunt, dentiform, fifth smaller than others, but still of fair size. Fronto-orbital border five-sevenths and frontal border more than one-third of greatest width of carapace. Median notch a deep narrow V, lobes nearly straight viewed from above, denticulate. Chelipeds granulate, very unequal; carpus uneven, with an anterior groove, inner tooth strong. Manus with a deep superior groove, surface rugose above. Fingers of large cheliped strong (dactylus with large basal tooth), those of smaller cheliped longer, slenderer, and deflexed; color not extending on palm.

Length of large male, 5.5 mm.; width, 7 mm.; fronto-orbital width, 5 mm.; frontal width, 2.5 mm.

Florida Keys; St. Thomas. Mayaguez Harbor and Puerto Real, Porto Rico.

Hexapanopeus quinquedentatus, sp. nov.

Carapace deeply areolated, the regions separately convex, granulate; epigastric lobes prominent. The antero-lateral margin has five well-marked teeth, second separated from first by a deeper sinus than is usual in this and allied genera. Third, fourth, and fifth teeth larger, similar to one another, thickened, subacute. Front with a median V, lobes slightly oblique, nearly straight. Chelipeds not very heavy, slightly unequal in male, equal in female, coarsely granulate. Carpus uneven; a short and very deep anterior groove. Manus deeply grooved above; fingers deeply grooved, the intervening ridges partly granulate; tips acute; fingers not gaping; dactylus of larger cheliped of male with a large basal tooth. Legs granulate along anterior margin. There are seven distinct segments in abdomen of male (at least in immature specimens), while in other species of the genus, the third to fifth are fused.

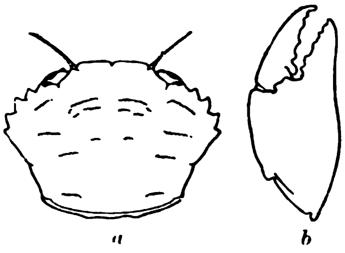

FIG. 6.—*Hexapanopeus quinquedentatus.* (*a*) Female, outline of carapace, × 4. (*b*) Male, right chela, × 10.

The largest specimen taken is a female, 5.5 mm. long; 7.4 mm. wide; fronto-orbital width, 5 mm.; frontal width, 2.4 mm.

Type locality, Mayaguez, 1 female (Cat. No. 23769). Also taken at Mayaguez Harbor, 12 fathoms, station 6060, 1 female; off Puerto Real, 8½ fathoms, station 6074, 1 immature male; off Boca Prieta, 8½ fathoms, station 6085, 1 immature male.

Genus MICROPANOPE Stimpson.

Micropanope Stimpson, Bull. Mus. Comp. Zool., II, 139, 1871.

Carapace of moderate width, slightly convex, regions usually lightly indicated, granulous or spinulous toward frontal and antero-lateral borders. Antero-lateral borders arcuate, shorter than postero-lateral, armed usually with five teeth or spines, of which the last is much reduced and the second also reduced or altogether wanting. Postero-lateral borders moderately converging. Fronto-orbital width great, three-fourths or more than three-fourths width of carapace. Front more than one-third the width of carapace. Front bilobed, outer angle rectangular, blunt, and situated below and in advance of inner orbital angle. Upper orbital margin with two small open notches and an intermediate lobe; inferior margin with a large outer notch; inner tooth prominent. Inner orbital hiatus wide; basal segment of antennæ not reaching, or barely reaching, prolongation from front. Chelipeds unequal in both sexes, and usually roughened by sharp granules or spinules. Fingers pointed. Legs slender, usually spinulous above. Abdomen of male with third to fifth segments fused.

Small species, living in deepish water.

Key to the Porto Rican species of the genus Micropanope.

A. Fronto-orbital width more than four-fifths of entire width of carapace ....*lobifrons*
A'. Fronto-orbital width seven-tenths of entire width of carapace ....*xanthiformis*

Micropanope lobifrons A. Milne Edwards.

Micropanope lobifrons A. Milne Edwards, Crust. Rég. Mex., 327, pl. LIII, f. 3, 1880.

Carapace almost smooth; some very small granules on gastric lobes and on branchial region; regions faintly indicated. Front wide and formed of two rounded lobes. Antero-lateral borders five-toothed, first or orbital tooth small; second triangular and about the same size; third and fourth spiniform, most prominent, the third the larger; fifth almost obsolete. Chelipeds covered with small pointed granules; an inner carpal spine; fingers deeply grooved. Ambulatory feet long, spinulous.

Length of male, 3.3 mm.; width, 4.3 mm.; fronto-orbital width, 3.7 mm.; width of front, 1.7 mm.

Off Montserrat, 88 fathoms (type locality); off Habana; near Aspinwall, 34 fathoms; off St. Thomas, 20 to 23 fathoms, station 6079, *Fish Hawk*.

Micropanope xanthiformis (A. Milne Edwards).

Panopeus xanthiformis A. Milne Edwards, Crust. Rég. Mex., 353, pl. LIII, f. 4, 1880.
Micropanope xanthiformis Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 274, 1898.

Carapace depressed, coarsely granulous on anterior half; regions well marked; an oblique ridge on hepatic region. Front deflexed; lobes separated by narrow fissure; margins sinuous, on the whole convex, with a distinct rectangular outer corner. Orbits wide, margin finely crenulate. Five antero-lateral teeth; second small, blunt, in adults considerably larger than postorbital angle, in the young obsolete; third and fourth large, acute; last very small and pointed; teeth with granulous margins. Chelipeds rugose with very fine granules. Arm with a row of spines above; wrist with a deep anterior groove and two inner spines, one smaller and below the other; hand roughened on its upper and proximal portions, a deep groove above. Fingers deeply grooved; dactylus of large hand with large basal tooth. Meral joints of legs with a row of spines above, other joints spinulous.

Length of male, 7 mm.; width, 10 mm.; fronto-orbital width, 7 mm.; frontal width, 3.7 mm.

From Cape Hatteras, N. C., to Cape Frio, Brazil, in 15 to 182 fathoms. Off Puerto Real, Porto Rico, 8¼ fathoms, station 6074, 1 young specimen.

Genus GLYPTOPLAX Smith.

Glyptoplax Smith, Trans. Conn. Acad. Sci., II, 164, 1870.

Carapace narrow, hexagonal, deeply areolated, front prominent, antero-lateral margin dentate. Chelipeds short and stout; manus more or less crested above, the upper proximal angle often very prominent; ambulatory legs slender and smooth. First segment of abdomen of male reaches coxæ of fifth pair of feet; second segment is shorter and exposes a portion of sternum; third segment may or may not reach coxal joints; third, fourth, and fifth segments coalesced.

This genus inclines toward the *Catometopa*.

Glyptoplax pusilla (A. Milne Edwards).

Micropanope pusilla A. Milne Edwards, Crust. Rég. Mex., 327, pl. LIV, f. 4, 1880.
Glyptoplax pusilla Rathbun, Jour. Inst. Jamaica, II, 628, 1899.

Surface very finely granulate. Front with a median emargination; lateral lobes sinuous. A distinct lobe on superior orbital margin between the two fissures. Second normal tooth of lateral margin obsolete; third and fourth dentiform, prominent; fifth tooth slight, situated on postero-lateral margin. Carpus of chelipeds with a tooth at inner angle and a groove parallel to anterior margin; manus with superior proximal angle prominent, margined; height of larger palm nearly as great as its length; pollex scarcely deflexed; fingers unevenly dentate, fitting closely together, the dactylus having a large basal tooth; color of pollex does not extend quite to palm. The smaller cheliped differs considerably in size and has the fingers bent down, dactylus without a large basal tooth. The third abdominal segment reaches coxæ of fifth pair of feet. Length of male, 4 mm.; width, 5.2 mm.

Gulf of Mexico, 17 to 35 fathoms; Oyster Bay, Florida; Jamaica. Porto Rico: Mayaguez Harbor, 4 to 6 fathoms, station 6065; off Humaçao, 9½ to 12½ fathoms, stations 6098 and 6099; off Vieques, 6 to 16 fathoms, stations 6085, 6091, 6092, and 6096; off Culebra, 14¾ to 15 fathoms, stations 6086 and 6093; off St. Thomas, 20 fathoms, station 6080. The female from this haul has a rhizocephalic parasite on the abdomen.

Genus ACTÆA de Haan.

Actæa de Haan, Fauna Japon., pp. 4 and 18, 1833.

Carapace convex fore and aft, slightly convex or flat from side to side, usually broad, regions well demarcated by deep grooves and again subdivided into lobules, which are usually convex and granular. Antero-lateral borders usually four-lobed, but lobes shallow and often indistinct. Postero-lateral borders usually concave, always short, not strongly convergent. Front between a third and a fourth the greatest width of carapace, deflexed, cleft in middle line into two lobes. Upper edge o. orbit tumid, usually with two fissures or sutures; a third below outer orbital angle; eye-stalks short and thick. Antennules folding obliquely or nearly transversely. Basal antennal joint usually stopping at angle of deflexed front, but often prolonged beyond this, toward or nearly into orbit; flagellum about as long as orbit and lodged in the orbital hiatus. Merus of external maxillipeds with anterior border little oblique. Chelipeds equal in both sexes; fingers either acute or blunt-pointed, sometimes hollowed out at tip. Abdomen of the male five-jointed, somites three, four, and five fused.

Key to the Porto Rican species of the genus Actæa.

A. Carapace, chelipeds, and legs granulous, not spinous.
  B. Lobules of carapace very markedly isolated and very convex .... *rufopunctata nodosa*
  B′. Lobules of carapace not remarkably isolated.
    C. Fingers deeply grooved and granulated .... *setigera*
    C′. Fingers smooth .... *bifrons*
A′. Carapace, chelipeds, and legs spinous .... *acantha*

Actæa rufopunctata nodosa (Stimpson).

Actæa nodosa Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 203, 1860.
Actæa rufopunctata var. *nodosa* Miers, *Challenger* Rept., Zool., XVII, 122, 1886.

Carapace broad, ovoid, its extreme length not quite three-fourths, but more than two-thirds its extreme breadth; its surface broken by deep and broad grooves into numerous (about twenty-seven, excluding those around the orbits and the front) very convex lobules, which are covered very closely with large vesiculous granules; grooves filled with a dense short felt, with longer hairs sometimes interspersed, against which the lobules stand out like islands. Exposed surface of carpal and propodal joints of chelipeds and legs lobulated in same style as carapace. Front strongly deflexed, but somewhat prominent and rather sharply bilobed. The tumid supraorbital margin broken by two cross grooves and separated from lower margin of orbit by a fissure. Antero-lateral borders cut into four rounded lobules of nearly equal size by deepish fissures. Outer angle of basal antennal joint in contact with inner angle of lower edge of orbit. Edges of legs and of arm fringed with coarse hair. Lower outer surface of hand with granules arranged in lines. Fingers blunt-pointed, hollowed out at tip.

Length of female, 12 mm.; width, 17.5 mm.; fronto-orbital width, 9 mm.; frontal width, 5 mm.

Florida Reefs; West Indies; Bahia, Brazil (Miers). Porto Rico: Off Vieques, 6 fathoms, station 6096; Ensenada Honda, Culebra; Fajardo.

This form is perhaps not subspecifically distinct from *A. rufopunctata* of the Oriental and East Atlantic regions, but I have not the material to determine this point.

Actæa setigera (Milne Edwards).

Xantho setiger Milne Edwards, Hist. Nat. Crust., I. 390, 1834.
Actæa setiger Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 51, 1859.

Carapace wide, ovoid, covered with short, stiff yellow hair and with granules; strongly lobulated anteriorly. Antero-lateral border divided into four lobes, which do not project beyond the general outline of the carapace. Postero-lateral borders concave. Median notch of front large. Basal antennal joint short, not prolonged into orbit. Pterygostomian regions finely granulous. Chelipeds hairy and very granulous; fingers slightly deflexed, black, this color extending in full-grown males upon external and internal surfaces of palm almost to articulation with wrist; in females the fingers only are black. Fingers grooved, intervening ridges granulous on the proximal half; tips acute. Legs covered with hairs; meral joints of first three pairs smooth outside and granulous on margins; of last pair, granulous on outside also; two following joints granulous; dactyls long, granulous, and terminating in a sharp nail. Abdomen of the male long and narrow.

Length of male, 16 mm.; width, 24.2 mm.; fronto-orbital width, 11.5 mm.; frontal width, 6 mm.

Bahamas; Florida Keys; West Indies; Bermudas. Porto Rico: Playa de Ponce Reef; Caballo Blanco Reef, Vieques; Ensenada Honda, Culebra; San Juan (G. M. Gray).

Actæa bifrons Rathbun.

Actæa bifrons Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 262, pl. IV, figs. 3 and 4, 1898.

Allied to *A. setigera;* carapace narrower and flatter; areolations similar, granulation finer, marginal lobes more angular; hairs dark brown. Front with a double edge, the inferior slightly in advance of superior, but scarcely noticeable in a dorsal view; the two lobes of superior margin slightly arcuate, margin denticulate or granulate; lower margin viewed from in front sinuous; surface between the two margins concave. Epigastric region coarsely granulate. Eyes larger than in *A. setigera;* inferior orbital margin with a prominent tooth at inner angle. The chelipeds differ from those of *A. setigera* in having the fingers longer in proportion to the palm, more strongly bent downward, pollex wider at base than dactylus. Fingers horn color (the color extending one-third the length of palm in male) and almost smooth, being marked with lines of shallow pits; tips acute.

Length of female, 5.3 mm.; width, 7.5 mm.; fronto-orbital width, 4.7 mm.; frontal width, 2.6 mm.

Off Aspinwall, 34 fathoms (type locality); off Vieques, 12 fathoms, station 6094; Ensenada Honda, Culebra.

Actæa acantha (Milne Edwards).

Cancer acanthus Milne Edwards, Hist. Nat. Crust., I, 379, 1834.
Actæa acantha A. Milne Edwards, Nouv. Arch. Mus. Hist. Nat. Paris, I, 278, pl. XVII, f. 1, 1865.
Actæa spinifera Kingsley, Proc. Acad. Nat. Sci. Phila., XXXI, 1879, 392, 1880.

Carapace and feet covered with long hairs; lobules of anterior portion of carapace very prominent, covered with pointed tubercles or spinules, between which are deep smooth grooves. Frontal lobes rather well advanced, separated by a relatively broad median cut. Margin of front and orbits armed with spines. Antero-lateral margin cut into five lobes, each armed with three or four spines; outer orbital angle also spinulous. Postero-lateral borders concave. Posterior margin marked by rows of tubercles. Basal article of antenna spinulous. Merus of outer maxillipeds tuberculous, margins denticulate. Chelipeds subequal. Wrist and hand covered with spines; fingers short, spinulous, blunt, and somewhat hollowed out at tips; white at tips, remainder black, the black color extending in old males over nearly the whole hand. Ambulatory feet spinous.

Length of female, 16 mm.; width, 24.2 mm.; fronto-orbital width, 12.5 mm.; frontal width, 6.5 mm.

Florida Keys: Jamaica; Guadeloupe; Fernando Noronha (Pocock). Off Gallardo Bank, Porto Rico, 10 fathoms, station 6076.

Genus XANTHIAS Rathbun.

Xanthodes Dana, Proc. Acad. Nat. Sci. Phila., VI, 75, 1852. (Name preoccupied.)
Xanthias Rathbun, Proc. Biol. Soc. Washington, XI, 165, 1897.

Carapace thick, but somewhat depressed, moderately broad, suboval, regions delimited and to a certain extent areolated in anterior two-thirds. Fronto-orbital border considerably more than half the greatest width of carapace in extent. Front broad, bilobed. Antero-lateral border cut into three or four lobes or teeth besides the orbital. Orbital margin with the three grooves either fairly distinct or quite indistinct. Basal antennal joint broad and very short; the flagellum, which is rather longer than orbit, lodged in orbital hiatus. Anterior edge of merus of external maxillipeds almost transverse. Chelipeds either equal or unequal in both sexes; the arm in repose is nearly or quite hidden beneath carapace; fingers pointed, not hollowed at tip. Legs stoutish, more or less hairy and granular or spiny along the upper border. Abdomen of male five-jointed.

Xanthias nuttingi Rathbun.

Xanthias nuttingi Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 271, pl. IV, f. 1, 1898.

Carapace suboval, convex in an antero-posterior direction, nearly flat in a transverse direction; anterior half rough with scaly granules; regions distinct. Front convex and having two lobes with granulate margins, separated by a V-shaped sinus. Antero-lateral margin with three sharp-pointed teeth besides the orbital, which is obliquely truncate and not prominent; posterior tooth smallest. Margin of orbits and of lateral teeth granulate. Second normal tooth of this genus (or that next the orbital) obsolete in this species. Outer fissure of orbit broad and V-shaped. Chelipeds heavy, unequal, arm spinulous on upper edge; wrist covered with bead-like tubercles, with a deep anterior groove and a small inner tooth terminating in a spinule. Larger hand in male with upper and about two-thirds of outer surface ornamented with bead tubercles; lower third and distal extremity smooth and shining; fingers broad, not gaping, brown with light tips; dactylus with a large basal tooth; color of pollex not running back on the manus, but forming a line with articulation of dactylus. Smaller hand almost entirely covered with tubercles, which grow smaller toward distal and lower margin; upper margin with a longitudinal groove; fingers deeply grooved. Upper margins of ambulatory legs tuberculate or granulate. The females differ in having the whole outer surface of the larger as well as the smaller tuberculate.

Color in alcohol, speckled with blue; larger patches of blue on anterior gastric and cardiac region.

Male: Length, 4 mm.; width, 5.5 mm.; fronto-orbital width, 4 mm.; frontal width, 2 mm.

Bahama Banks; Gulf of Mexico and Caribbean Sea, 21 to 25 fathoms; Jamaica; off Cape St. Roque, Brazil, 20 fathoms. Porto Rico: Mayaguez Harbor, 25 to 30 fathoms, station 6062, and 4 to 6 fathoms, station 6065; off Boca Prieta, 8½ fathoms, station 6075; Playa de Ponce Reef; off St. Thomas, 20 fathoms, station 6080; off Vieques, 14 fathoms, station 6085; off Humaçao, 9½ to 12½ fathoms, stations 6098 and 6099.

Genus **EUCRATODES** A. Milne Edwards.

Eucratodes A. Milne Edwards, Crust. Rég. Mex., 346, 1880.

Carapace oval, of moderate width, antero-lateral margins arcuate, feebly dentate, postero-lateral slightly converging. Fronto-orbital width about two-thirds the greatest width of carapace. Frontal lobes entire. No upper or outer fissures on orbital margin. Basal article of antennæ short, just touching a prolongation of front; the flagellum lies in the orbital hiatus. Antennules folded transversely. Buccal cavity broad; margin of epistome with two notches on each side; endostome without ridge. Merus of outer maxillipeds subquadrilateral, notched at inner angle for articulation of palpus. Chelipeds of moderate size and nearly equal; fingers pointed. Ambulatory legs slender, smooth; dactyli elongate. Third, fourth, and fifth segments of abdomen fused; third segment angular at sides, reaching coxæ of fifth pair of feet.

Eucratodes agassizii A. Milne Edwards.

Eucratodes agassizii A. Milne Edwards, Crust. Rég. Mex., 347, pl. LXI, f. 1, 1880; Bull. Mus. Comp. Zool., VIII, 14, 1880.

Carapace thick, very convex in an antero-posterior direction, slightly convex transversely; regions scarcely indicated; surface smooth to naked eye, but under the lens it is punctate and obscurely granulate, except along antero-lateral margin, where the granules are plainly seen. Antero-lateral margin obscurely five-toothed, first or orbital tooth small; second rounded and separated from the first by a shallow sinus, as in species of *Eurypanopeus;* third larger, but little prominent; fourth most prominent; fifth small. Front slightly bilobed; a short closed median fissure; margin thin. Lower surface of carapace coarsely granulate. The arm has a superior subterminal tooth, the wrist a blunt inner tooth. Surface of chelipeds similar to that of carapace; lower surface of palms coarsely granulate. Dactylus of large hand with a large basal tooth. The brown color of the thumb covers only its distal half. The chela figured by Milne Edwards is the smaller of the two; the larger is more swollen.

Color, pale yellow; fingers brown (A. Milne Edwards).

Dimensions of male: Length, 6.2 mm.; width, 8.5 mm.; fronto-orbital width, 5.5 mm.; frontal width, 2.8 mm. A young male measures 3.3 mm. long by 4.2 mm. wide.

The specimen described by A. Milne Edwards was intermediate in size and also in proportionate width between the two taken by the *Fish Hawk*. It will be seen that our largest example is considerably wider than the type, also more oval and shows two additional lateral teeth. In the smaller example, the second lateral tooth is scarcely distinguishable; the fifth almost obsolete. I have little doubt, therefore, that these are the veritable *Eucratodes agassizii*, a rare species, not having been recorded since its original description.

Off Aguadilla, 137 fathoms, station 6055; Mayaguez Harbor, 161 to 172 fathoms, station 6066.

In regard to the type locality, the west coast of Florida, 100 fathoms, is the locality accompanying the original description; but in the Bull. Mus. Comp. Zool., VIII, 14, the locality is given as lat. 21° 14′ N., 100 fathoms, Stimpson, collector. This entry is probably a corrected one. Dr. Stimpson made a series of dredgings in the Yucatan Channel while on the U. S. Coast Survey steamer *Bibb*.

Genus CHLORODIELLA Rathbun.

Chlorodius Milne Edwards, Hist. Nat. Crust., I, 399, 1834. (Not *Clorodius* Leach in Desmarest, 1823.)
Chlorodiella Rathbun, Proc. Biol. Soc. Washington, XI, 157, 1897.

Carapace depressed, flat, hexagonal, the regions partially or not at all demarcated, surface smooth and almost unbroken, except sometimes anteriorly and on branchio-hepatic region, near antero-lateral border, where there may be some broad transverse wrinkles. Fronto-orbital border varying from about two-thirds to more than three-fourths the greatest breadth of carapace. Front almost straight, emarginate in middle line, extremely broad (between a third and a half the greatest breadth of carapace), its outer angles separated from the supra-orbital margin by a groove. Antero-lateral borders cut into four lobes or teeth. Postero-lateral borders rather longer than the antero-lateral. Orbit with two suture lines above and one at the outer angle; eyes on short thick stalks. Basal antennal joint large, extending upwards and outwards into gap between front and orbit; flagellum in crevice-like orbital hiatus. Merus of external maxillipeds with anterior border almost transverse. Chelipeds unequal, long, more than twice the length of carapace, half or more of arm projecting beyond edge of carapace; fingers large, broadened, and deeply hollowed at tip. Legs spinulous. Abdomen of male consisting of five joints, the third to fifth somites being fused.

Chlorodiella longimana (Milne Edwards).

Chlorodius longimanus Milne Edwards, Hist. Nat. Crust., I, 401, 1834.
Chlorodiella longimanus Rathbun, Ann. Inst. Jamaica, I, 14, 1897.

Gastric region faintly indicated. Smooth transverse ridges on the epigastric, protogastric, hepatic, and anterior branchial regions. Postorbital and branchio-hepatic furrows deep. Antero-lateral borders cut into four teeth besides orbital, the first two obtuse and tuberculiform, the last two longer and acute. Front with a double edge, the upper one truncate, feebly notched in middle, the lower one with a deeper notch, and oblique lobes projecting beyond upper; outer corners turned down to meet antennal joint. Anterior margin of merus of outer maxillipeds has a moderately deep sinus. Chelipeds very long; two-thirds of arm projects beyond carapace, its anterior margin armed with four or five teeth or spines; wrist smooth and bearing a spine or a tubercle at inner angle; hand long and smooth; fingers stout and black, the black color of pollex extending a little on hand. Legs granulous above and hairy.

Dimensions of male: Length, 14 mm.; width, 22.5 mm.; fronto-orbital width, 14.4 mm.; width of front, 7 mm.; approximate length of cheliped, 46 mm.

Florida Reefs; West Indies; Curaçao. Porto Rico: Mayaguez; Ponce; Arroyo, on Light-house Reef; Ensenada Honda, Culebra; San Juan (Gundlach), also collected by G. M. Gray.

Genus MENIPPE de Haan.

Menippe de Haan, Fauna Japon., pp. 4 and 21, 1833.

Carapace broad, transversely oval, moderately convex fore and aft, very slightly so from side to side; regions, except gastric, little defined. Antero-lateral borders long, strongly arched, cut into four teeth besides orbital; postero-lateral borders slightly shorter than antero-lateral, convergent; posterior border short. Front narrow, a fifth or less than a fifth the greatest breadth of carapace, rather prominent, almost horizontal, cut into two lobes, the outer angle of each of which forms a distinct tooth. Orbit with three grooves near the outer angle well marked; inner orbital angles, both upper and lower, well pronounced. Eyes on short, thick stalks. Side edges of front not turned down, and the short basal antennal joint does not nearly reach the front, so that the cavities of orbits and antennules are not properly separated; next antennal joint just reaches front, and the long antennary flagellum stands in orbital hiatus. Antennules fold nearly transversely. Anterior edge of merus of external maxillipeds oblique and a little sinuous but not excised. Ridges of endostome complete, but low and faint. Chelipeds massive, a little unequal in both sexes; fingers stout, pointed, not hollowed. Abdomen of male singularly broad, all seven segments distinct.

Menippe nodifrons Stimpson.

Pseudocarcinus rumphii Milne Edwards, Hist. Nat. Crust., I, 408, 1834. (Not *Cancer rumphii* Fabricius, Ent. Sys., Suppl., 336, 1798.)
Menippe rumphii Dana, Crust. U. S. Expl. Exped., I, 179, 1852.
Menippe nodifrons Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 53, 1859.

Gastric region distinct and lightly subdivided into three lobes; between it and the front are four large tubercles forming a quadrilateral, the anterior pair farther apart than posterior. A low indistinct elevation, nearly parallel with curve of antero-lateral border, crosses either branchial; another ridge, less distinct, crosses gastric and hepatic regions. Surface closely granulate and coarsely pitted. Front is a little more than a fifth of greatest breadth of carapace, and consists of two prominent round-pointed lobes, outside of each of which are two smaller rounded lobes; the inner of these is sometimes obliterated in the old. Antero-lateral border rather sharp and divided into four prominent lobes, of which the first two are broadly rounded, last two dentiform, obtuse, strongly projecting; from the last one a ridge extends obliquely inward on carapace. Chelipeds finely granulate and with distinct pits; inner angle of wrist bluntly prominent. Legs stout, granular above; upper border of carpal joints and both borders of propodi hairy; dactyli more thickly hairy.

Dimensions of male: Length, 46.2 mm.; width, 67 mm.; width of front, 14.3 mm.

From Indian River, Florida (U. S. Fish Commission), and Gulf of Mexico to Brazil. Mayaguez (Gundlach, as *Menippe rumphii*). I have seen no specimen of this from Porto Rico; it is undoubtedly the species noted by Gundlach, but not *Cancer rumphii* Herbst.

Genus OZIUS Milne Edwards.

Ozius Milne Edwards, Hist. Nat. Crust., I, 404, 1834.

Carapace broad, transversely oblate-oval, moderately convex fore and aft, slightly convex or nearly flat from side to side; the regions, except gastric, little defined; the surface smooth or granular, often rugose anteriorly. Antero-lateral borders of good length, strongly arched, usually broadly crenate or lobulate; postero-lateral borders convergent, about as long as or shorter than antero-lateral. Front rather broad (considerably more than a fourth the greatest breadth of carapace), obliquely deflexed, cut into four lobules or teeth of about equal size, separated from orbit by a notch. Orbits deep, rather small, the grooves near outer angle inconspicuous; eyes on short, thick stalks. The antennules fold nearly transversely. Basal antennal joint prolonged between side of front and orbital plate; the flagellum, which is very small (about half the major diameter of the orbit in length), stands in orbital hiatus. The ridges of the endostome, defining the expiratory channels, are very strong, and the opposed margin of the merus of the external maxillipeds is notched, usually very deeply, so that a permanent expiratory orifice results. Chelipeds massive, unequal in both sexes; the fingers of good length, pointed, not hollowed. The abdomen of the male consists of seven segments.

Ozius reticulatus (Desbonne & Schramm).

Lagostoma reticulata Desbonne & Schramm, Crust. Guadeloupe, 34, pl. IV, f. 6, 1867.
Ozius reticulatus A. Milne Edwards, Crust. Rég. Mex., 278, pl. LV, f. 3, 1880.

Carapace more than 1.5 times as wide as long; deeply corroded along the antero-lateral borders, covered with depressed granules. Front bimarginate. Antero-lateral margin somewhat crenate in front and having behind indications of three teeth. Claws corroded. Fingers dentate, those of larger claw gaping, and with a large basal tooth on the dactyl.

Wine color or a dirty rose, with spots of fawn color. Fingers brown.

Male: Length, 15 mm.; width, 23.8 mm.; fronto-orbital width, 9.7 mm.; frontal width, 5.8 mm.

West Indies; Sabanilla, United States of Colombia. Ensenada Honda, Culebra (*Fish Hawk*).

Genus PILUMNUS Leach.

Pilumnus Leach, Trans. Linn. Soc. London, XI, 309 and 321, 1815.

Carapace and legs generally thickly covered with hair. Carapace transversely oval or subquadrilateral, declivous anteriorly, flat posteriorly, not greatly broader than long; the regions, as a rule, but moderately plainly demarcated and areolated. Antero-lateral borders not longer, but commonly shorter than postero-lateral, and cut into teeth which, very commonly, are spiniform. Front usually about a third the greatest breadth of carapace, but sometimes broader. It is cut into two lobes, the outer angle of each of which commonly forms an independent dentiform or spiniform lobule separated from supra-orbital angle by a groove or notch. The orbits generally have a gap or fissure just below outer angle, and one or two gaps or notches in upper border; inner lower orbital angle commonly sharp and prominent. Eyes moderately long and slender. The antennules fold transversely. Basal antennal joint short, either not quite touching the front or just touching it by its inner angle; the flagellum, which is planted in the orbital hiatus, is long, usually very much more than major diameter of orbit. Ridges of endostome, defining expiratory channels, are usually plain, but not very high; anterior border of merus of external maxillipeds almost transverse and not notched. Chelipeds stout, the fingers coarse, short, and pointed. Legs usually stout and of moderate length. The abdomen of male consists of seven separate segments.

Key to the Porto Rican species of the genus Pilumnus.

A. Carapace for the most part concealed by a short, thick pubescence, which when removed discloses tubercles on the hepatic regions and, usually, on the gastric also.
B. Frontal lobes concave, entire .... *reticulatus*
B′. Frontal lobes convex, and granulate or denticulate.
C. Outer surface of palms more or less hairy.
D. Entire outer surface of palms tuberculate .... *gemmatus*
D′. Outer surface of palms partially smooth and naked.
E. Antero-lateral projections, after the pubescence is removed, spiniform, curved, sharp .... *pannosus*
E′. Antero-lateral projections, after the pubescence is removed, dentiform, short, obtuse .... *holosericus*
C′. Outer surface of palms wholly naked or free from hair .... *nudimanus*
A′. Carapace, when covered by a short, thick pubescence, not having the gastric region tuberculate.
B. Outer surface of larger hand only partially covered with tubercles or spines.
C. Carapace covered with hair .... *floridanus*
C′. Carapace naked on posterior half .... *dasypodus*
B′. Outer surface of larger hand entirely covered with tubercles or spines.
C. Four lateral spines, including the orbital .... *brasiliensis*
C′. Three lateral spines, the orbital missing .... *marshi*

Pilumnus reticulatus Stimpson.

Pilumnus reticulatus Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 214, 1860.
Pilumnus tessellatus A. Milne Edwards, Crust. Rég. Mex., 295, pl. LI, f. 2, 1880.

Carapace, upper surface of chelipeds, and also the legs clothed with short, thick setæ, closely arranged in reticulating lines, inclosing small, naked, polygonal areolæ, which on anterior half of carapace and on chelipeds are mostly each occupied by a tubercle projecting forward, but flattened on its superior and posterior surface. About twelve tubercles on carapace, excluding marginal ones, and fifteen or more on each cheliped. On the legs the naked areolæ form deep cavities not occupied by tubercles; about two areolæ occupy width of leg. Some much longer and larger clavate setæ are dispersed among the short ones which clothe the general surface. Margins of frontal lobes oblique and concave. Antero-lateral margin with four teeth (including the orbital) similar to the tubercles; there is also a subhepatic and a subbranchial tubercle. Three projecting teeth on lower margin of orbit, the inner one very large. Lower and distal two-thirds of outer surface of larger palm and half of smaller palm smooth and naked. Fingers also smooth; only a few setæ at base of dactylus.

Length of male, 8 mm.; width, 11 mm.

Jamaica; St. Thomas; Curaçao; Desterro and Pernambuco, Brazil (A. Milne Edwards). Porto Rico: Mayaguez; Playa de Ponce Reef; Arroyo; Puerto Real.

Pilumnus gemmatus Stimpson.

Pilumnus gemmatus Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 214, 1860. (Not *P. gemmatus* A. Milne Edwards.)

Carapace rather narrow, covered, as also are the chelipeds and legs, with a short, close pubescence (with occasional stout and long cylindrical setæ), which does not conceal boundaries of regions and the small red beads or tubercles scattered on anterior half of carapace, upper and outer surfaces of chelipeds, and upper surface of legs. Frontal lobes subtriangular, granulate on margin, more advanced near median line; interspace V-shaped. Antero-lateral projections four, short, stout and blunt or subacute. Upper orbital margin with a few red tubercles; lower margin finely denticulate, a small outer notch. Entire outer surface of both hands tuberculate, the tubercles growing smaller toward lower margin. Both fingers deeply grooved; tubercles on upper portion of basal half of dactylus; a few on outer surface of pollex. Outer lower margin of arm with a broad band of tubercles and granules.

Length of male, 7.8 mm.; width, 10.4 mm.

Tortugas; St. Thomas; Curaçao. Taken by the *Fish Hawk* at Ensenada Honda, Culebra, and off St. Thomas, 20 to 23 fathoms, station 6079.

Pilumnus pannosus Rathbun.

Pilumnus gemmatus A. Milne Edwards, Crust. Rég. Mex., 290, pl. LI, f. 4, 1880. (Not *P. gemmatus* Stimpson, 1860.)
Pilumnus pannosus Rathbun, Proc. U. S. Nat. Mus., XIX, 142, 1896.

Resembles *P. gemmatus* Stimpson. Carapace wider and less quadrate than in *P. gemmatus*, entirely covered with a soft, thick pubescence, which is not evenly distributed; here and there are longer, irregular, club-shaped setæ, which give the crab a very ragged appearance. Anterior half of carapace and upper surface of chelipeds and legs dotted with bead-like tubercles, larger than in *P. gemmatus*. Frontal lobes subtriangular, granulate on the margin, more advanced near median line; interspace V-shaped. The antero-lateral projections look like shallow lobes until pubescence is removed, when they are seen to be triangular, well-separated spines with slender tips pointing forward. Upper margin of orbit with two tuberculiform spines near inner angle and two between those and outer angle; lower margin with a row of short, stout, blunt spines or tubercles of unequal size, and a V-shaped notch next the outer angle.

The upper portion of hands tuberculate, but greater part of outer surface smooth and naked; smaller hand almost entirely covered with tubercles and granules; its lower distal portion bare. The pollex is smooth, and there are but a few tubercles on the dactylus near its articulation. Fingers with shallow grooves, which in the larger cheliped consist of shallow punctæ. Outer lower margin of the arm smooth for its proximal half. Ambulatory legs pubescent and bordered with fringes of club-shaped setæ mixed with long fine hairs.

Length of male, 8.6 mm.; width, 12 mm.

Bahama Banks; Gulf of Mexico; Florida Keys; Jamaica; St. Thomas. Reefs at Ponce, Porto Rico.

Pilumnus holosericus Rathbun.

Pilumnus holosericus Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 268, pl. V, f. 1, 1898.

Allied to *P. gemmatus* and *P. pannosus*. Carapace more oval than in those species. Surface covered with a short, smooth velvety pubescence which does not conceal boundaries of areolations. On either side of gastric region is a tuft of long hairs. Antero-lateral teeth shorter than in *P. gemmatus* and *P. pannosus* and blunt, even when pubescence is removed. Tubercles of carapace and chelipeds smaller and more numerous than in allied species. Larger hand with lower and distal portion of outer surface bare and unarmed, but this space is smaller than in *P. pannosus*. Fingers shorter than in that species. Smaller hand with entire outer surface pubescent and hairy. Ambulatory legs pubescent and fringed with long hairs.

Length of male, 6.1 mm.; width, 8.3 mm.

Bahamas; St. Thomas; St. John. Porto Rico: Mayaguez, on coral reef; Puerto Real; Boqueron Bay, on coral reef; reefs at Ponce; Arroyo.

Pilumnus nudimanus, sp. nov.

Carapace covered with a short, dense pubescence (easily rubbed off) among which are a few tufts of longer stout setæ on the frontal, gastric, and anterior branchial regions. On hepatic region is an oblique row, parallel to antero-lateral margin, of five or six small, reddish-brown bead-like tubercles, visible amid pubescence. Antero-lateral margin armed with three spines, stout at their base, but sharp at ends, which are hooked forward. Upper orbital margin has two or three bead-like tubercles similar to those of hepatic row; lower margin finely granulate or crenulate. Median sinus of front V-shaped, margins of lobes outside the sinus obliquely convex and finely granulate; the outer frontal tooth is small, with a reddish tubercle at tip. Upper margin of arm has a strong distal, subterminal tooth. The wrist is densely pubescent except in a narrow groove parallel to distal margin, and bears also a number of large tubercles of which there are in large cheliped about twenty-six behind groove and eleven in front of it. Hands very unequal in female, and naked, but sparingly dotted on the outer surface with tubercles, except on lower third of larger hand, which is smooth. Pollex short and thick; dactyli with tubercles above near their base. Legs long-hairy, upper surface of carpal and propodal segments flattened and paved with depressed pear-shaped tubercles.

Dimensions of ovigerous female: Length, 6 mm.; width, 8.8 mm.

Type locality, Arroyo; one female (Cat. No. 23770). A young specimen also was taken at Arroyo on the Lighthouse Reef.

This species in the arrangement of tubercles on the carapace, in the bare and tuberculated palms, and in the peculiar vertically flattened ambulatory legs, differs from all others found in America.

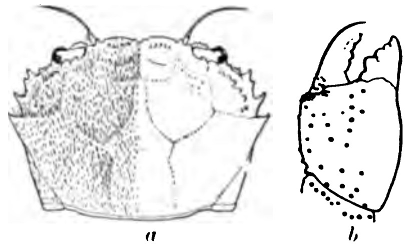

FIG. 7.—*Pilumnus nudimanus*, female. (*a*) Carapace, × 4. (*b*) Large chela, × 5.33.

Pilumnus floridanus Stimpson.

Pilumnus floridanus Stimpson, Bull. Mus. Comp. Zool., II, 141, 1871.
Pilumnus lacteus A. Milne Edwards, Crust. Rég. Mex., 292, pl. LI, f. 5, 1880. (Not *P. lacteus* Stimpson, 1871.)

Carapace covered with a short pubescence and a few longer fine hairs, a transverse series of which, across the frontal region, forms a somewhat conspicuous feature; there are also a few long clavate setæ. Below the ciliated line the front is naked and its margin unarmed; its lobes are most strongly projecting near median sinus. Margin of orbit unarmed above, but armed below with eight or ten spiniform teeth. Antero-lateral margin with four spines, including orbital. A subhepatic spinule. No spines on hepatic region above. Whole outer surface of wrists and of smaller hand spinous; spines arranged in longitudinal rows on hands, on larger palm becoming obsolete near the lower and digital margins. Legs spinous.

Length of male, 7 mm.; width, 9.6 mm.

Distributed from the Gulf of Mexico to St. Thomas; Bahama Banks; to a depth of 30 fathoms. Porto Rico: Mayaguez Harbor, 25 to 30 fathoms, station 6062; off St. Thomas, 20 to 23 fathoms, station 6079; off Vieques, 16 fathoms, station 6092.

Pilumnus dasypodus Kingsley.

Pilumnus dasypodus Kingsley, Proc. Boston Soc. Nat. Hist., XX, 155, 1879.
Pilumnus vinaceus A. Milne Edwards, Crust. Rég. Mex., 283, pl. L, f. 2, 1880.

Carapace on its anterior two-thirds covered with long, fine hair with occasional stouter setæ interspersed; upper part of chelipeds and surface of legs similarly clothed. Anterior half of carapace roughly granulate. Antero-lateral margin armed with four long, sharp spines curved slightly forward. Frontal lobes more advanced toward the middle than toward outside and armed with short spines. Orbital border spinous. Chelipeds very unequal, spinous and granulate, except lower and distal two-thirds of hand, which is smooth and naked. The movable fingers have only a bunch of spinules and hairs at base. Legs spinous above.

Brownish wine color; feet brighter. Fingers and extremity of spines brown (A. Milne Edwards).

Dimensions of male: Length, 6.5 mm.; width, 9.1 mm.

Gulf of Mexico to Rio de Janeiro. Porto Rico: Mayaguez; Boqueron Bay; Puerto Real; reefs at Ponce; Ensenada Honda, Culebra.

Pilumnus brasiliensis Miers.

Pilumnus brasiliensis Miers, *Challenger* Rept., Zool., XVII, 151, pl. XIII, f. 2, 1886.

Carapace rather narrow, smooth, covered with short hair, and on anterior two-thirds rather thinly clothed with long, fine hairs; chelipeds and legs similarly clothed. Antero-lateral margin armed with four sharp spines; between the first and second a smaller spinule. Frontal lobes strongly deflexed, margins convex, spinulous; a small spine or spinule on tooth forming the outer angle, although Miers says this is obsolete. Orbital margin spinulous; inner half of lower margin spinous. Upper and outer surface of chelipeds clothed with spines, covering the palms (where they are arranged in longitudinal series) and basal portion of dactyli. Legs spinous above.

Dimensions of female: Length, 6 mm.; width, 7.7 mm.

Off Bahia, Brazil, 7 to 20 fathoms (type locality). Porto Rico: Off Vieques, 6 to 16 fathoms, stations 6085, 6091, 6092, 6096; off Culebra, 14¾ fathoms, station 6086.

Pilumnus marshi,[1] sp. nov.

This species in its general appearance is so like *P. brasiliensis* that at first glance one might take them to be the same. The carapace is, however, narrower, and the antero-lateral margin shorter, being only a little more than half the length of postero-lateral margin, whereas in *P. brasiliensis* the antero-lateral is nearly as long as the postero-lateral. There are only three lateral spines in our species, the spine at the outer angle of orbit being absent. The posterior of the spines is small and appressed, while in *P. brasiliensis* it is similar in size and direction to the other spines. The corneal extremity of the eye is much larger in our species. Fingers of chelipeds longer and more deeply grooved. Legs considerably longer than in the allied species; for example, the merus of last pair when flexed reaches farther forward than tip of penult antero-lateral spine; in *P. brasiliensis* the same joint fails to reach tip of posterior spine.

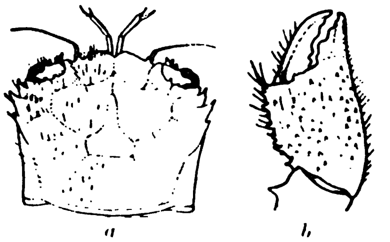

FIG. 8.—*Pilumnus marshi*, male. (*a*) Carapace, × 4. (*b*) Large chela, × 4.

Length of male, 5.5 mm.; width, 7 mm. Length of female, 5.7 mm.; width, 7.1 mm.

Type locality, off St. Thomas, 20 to 23 fathoms, station 6079, 1 male (Cat. No. 23771). Also taken at the next station, 6080, near the last, in 20 fathoms, 1 female.

Genus EURYTIUM Stimpson.

Eurytium Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 56, 1859.

Carapace broad (length about two-thirds width), convex, regions lightly marked, without transverse raised lines. Antero-lateral borders regularly arcuate, shorter than postero-lateral, cut into five shallow teeth, the second tooth rounded and intimately fused with first. Fronto-orbital border over half the width of carapace. Front from a fourth to almost a third the width of carapace. Front deflexed, two rounded lobes separated by a shallow notch. Superior margin of orbit with two short and inconspicuous fissures; lower margin with a deep rounded sinus outside, and two lobes, of which the inner and smaller is slightly more advanced than outer. Basal antennal joint broad and in contact with front; the flagellum stands in orbital hiatus. The ridge on the endostome which defines the efferent branchial channel is well marked, and continued to margin of epistome. Chelipeds massive and rounded, unequal in both sexes. The abdomen in male is five-jointed.

Allied to *Eupanopeus*, *Eurypanopeus*, etc., but distinguished by its oval and almost smooth carapace, without ridges, and by its palatal ridge.

Eurytium limosum (Say).

Cancer limosa Say, Jour. Phila. Acad. Sci., I, 446, 1817.
Panopeus limosus Milne Edwards, Hist. Nat. Crust., I, 404, 1834.
Eurytium limosum Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 56, 1859; A. Milne Edwards, Crust. Rég. Mex., 332, pl. LX, f. 2, 1880.

Carapace very convex in an antero-posterior direction; surface smooth to eye, but under lens granulate, the granules coarser near frontal and antero-lateral margins; two feeble epigastric lobes. Front one-fourth the width of carapace. Antero-lateral margin about two-thirds the length of postero-lateral, bordered by a raised line of granules; second tooth lobiform, separated from first by a shallow sinus;

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[1] In honor of Mr. M. C. Marsh, one of the naturalists of the expedition to Porto Rico.

third and fourth not prominent, outer margins arcuate; the fifth more prominent and dentiform, subacute. The granules of chelipeds fine and reticulate; no carpal groove; fingers pointed, color of fingers not continued on palm.

Color of carapace, a brilliant purplish blue; wrist and hand bluish; proximal upper half of movable finger pink; remainder of finger porcelain white; lower portion of chelipeds and also the carpal tooth yellow.

Length of male, 22 mm.; width, 32.8 mm.; fronto-orbital width, 17.4 mm.; frontal width, 8.1 mm.

New York to Brazil; Bermudas. Ensenada Honda, Culebra.

Genus ERIPHIA Latreille.

Eriphia Latreille, Nouv. Dict. Hist. Nat., x, 404, 1817.

Carapace thick and deep, approaching a quadrilateral shape, very little convex or nearly flat, not remarkably broader than long. Antero-lateral borders slightly curved, much shorter than postero-lateral, and meeting the latter, not at a strong angle, as in most cancrids, but at a very open and imperceptible angle; though spinate, they are not cut into lobes. Fronto-orbital border extremely broad, much more than three-quarters the greatest breadth of carapace; the front, which is therefore broad also, is strongly deflexed, almost straight, cut in the middle, the outer part on each side broadly in contact—far beyond limits of antennal base—with a singularly broad prolongation of infra-orbital plate. The orbits, which are deep and oval, are therefore completely closed and widely separated from the antennæ. Basal antennal joint very small, short, and broad; flagellum long, more than major diameter of large orbit. The antennules fold transversely. The crests of endostome, defining the expiratory canals, are strong, and the canal is completed below by the foliaceous process of first maxillipeds, the anterior edge of that process being concave. Oblique anterior border of merus of external maxillipeds not notched. Chelipeds massive, unequal in both sexes; fingers stout, pointed, not hollowed. The abdomen of the male has all seven segments separate.

Eriphia gonagra (Fabricius).

Cancer gonagra Fabricius, Sp. Ins., 505, 1781.
Eriphia gonagra Milne Edwards, Hist. Nat. Crust., I, 426, pl. XVI, figs. 16 and 17, 1834.

Carapace of moderate width, regions clearly marked on anterior two-thirds; postorbital grooves very deep; a transverse granulated line in front of epigastric lobes, another line across protogastric and hepatic lobes; a line of tubercles parallel to antero-lateral margins; these last armed with six spiniform teeth. Front very wide, deflexed, and divided into four lobes; the two median wider and more advanced than the lateral, truncate, with a finely granulated border; lateral lobes slightly concave in dorsal view. Fronto-orbital suture very sinuous; below it a line of large tubercles. Chelipeds strong, swollen, unequal. Hand covered with large, round, flattened, squamiform tubercles, more elevated on the small hand than on the large. The larger movable finger has a large rounded tooth at its base. Wrist covered with less prominent tubercles. Legs clothed with fine, stiff hairs on the last three segments.

Color, reddish brown or yellowish brown; the spines and margins of front and orbits orange; tubercles on upper half of claws dark red or blue, on lower half yellow; legs light yellow with fine red dots.

Male: Length, 26.5 mm.; width, 38.7 mm.; fronto-orbital width, 30 mm.; width of front, 19 mm.

South Carolina (Rankin); Florida Keys to Brazil; Bahamas; Bermudas. Porto Rico: Mayaguez, on coral reef; Boqueron Bay; Ponce reefs; Caballo Blanco Reef, Vieques; Ensenada Honda, Culebra; Hucares; Aguadilla (Gundlach).

Genus MELYBIA Stimpson.

Melybia Stimpson, Bull. Mus. Comp. Zool., II, 144, 1871.

Carapace rather narrow, subquadrate, slightly convex, regions faintly marked. Antero-lateral margins very short, with four teeth or spines, including the orbital. Fronto-orbital width great, about five-sixths the greatest width of carapace. Front about two-fifths the width of carapace. Front depressed, bilobed, separated by a notch from inner orbital angle. Orbits large, completely filled by stout eyes; two superior notches in margin, and a broader notch below on outside. Basal joint of antenna narrow, reaching a process of front and closing the orbital hiatus. Outer maxillipeds much smaller than buccal cavity; the exognath is half the width of endognath. Chelipeds unequal, long and strong, the arm reaching far beyond carapace, spinulous. Legs long and narrow, spinulous; dactyli long. Abdomen of male with third to fifth segments fused.

Melybia thalamita Stimpson.

Melybia thalamita Stimpson, Bull. Mus. Comp. Zool., II, 144, 1871.

Carapace somewhat convex, slightly pubescent; surface nearly even, minutely granulated. First tooth of antero-lateral margin small, sometimes bifid at tip; second and third teeth long, spiniform; fourth small, spiniform. Median notch of front large, V-shaped; margins of lobes nearly straight, sloping backward toward orbit. Margin of orbit minutely crenulated. Merus of chelipeds armed with spines on upper and inner margin. Carpus spinulous on outer surface; three spines along inner margin, middle one the longer. Manus with a double row of spines above. Fingers two-thirds as long as palm, broad, compressed, not gaping. Ambulatory legs sparsely hairy; merus with a row of spines on the anterior margin; one spine near distal end of posterior margin in the first three pairs. Dactylus nearly as long as propodus.

Length of male, 6.9 mm.; width, 9.8 mm.

Florida Straits to Aspinwall, 15 to 201 fathoms. Off Culebra, 15 to 15¼ fathoms, stations 6087 and 6093; off Vieques, 12½ fathoms, station 6095.

Genus DOMECIA Eydoux & Souleyet.

Domecia Eydoux & Souleyet. Voy. *Bonite*, I, Crust., 234, 1842.

Carapace somewhat transversely oval, but much contracted posteriorly, flat, somewhat hairy, with no trace of regions. Fronto-orbital border not much less than greatest breadth of carapace. Front profusely spinate, the spines being sharp and a little curved. The antero-lateral borders pass backward with but little outward slope, a little shorter than concave and convergent postero-lateral borders, and armed with a number of sharp curved spines. The orbits are at antero-lateral angles of carapace and do not conceal the eyes; their edge shows no fissures nor sutures; their upper and lower inner angles are broadly in contact, or almost in contact, so as to exclude antennæ. The antennules fold nearly transversely. The basal antennal joint hardly reaches the front, though its outer angle is produced toward front; the flagellum is short, hardly as long as orbit. Buccal cavern broad; crests of endostome not very strong, nor is the foliaceous process of first maxillipeds produced far forward; external maxillipeds very long, merus remarkably broad and short. Chelipeds somewhat unequal, short, and not very massive; arm almost entirely hidden by carapace; fingers compressed, pointed. Legs stout, especially meropodites. The abdomen of the male has all seven segments distinct and separate.

Domecia hispida Eydoux & Souleyet.

Domécie hérissée Eydoux & Souleyet, Voy. *Bonite*, pl. II, figs. 5 to 10, 1841 (?).
Domecia hispida Eydoux & Souleyet, Voy. *Bonite*, I, Crust., 235, 1842.

Carapace covered with light-colored hairs; antero-lateral border with five or six (including orbital angle) acute dark-tipped spines, and several similar spines on carapace just inside antero-lateral border, and also just inside spiny fronto-orbital border. Orbital margin and prominent edge of the epistome finely denticulate. Merus of external maxillipeds extremely broad and short, with an elevated patch of denticles on outer surface. Chelipeds a little unequal; the arm, wrist, hand, and dactylus are all studded with acute spines. Legs stout, of moderate length; anterior surface of last four joints fringed with hairs, anterior edge of merus spinate, as also, but much less distinctly, is the anterior edge of the carpus and propodus.

Length of male, 6.6 mm.; width, 9.3 mm.

Florida Reefs; West Indies; Pernambuco and Alagoas, Brazil; Cape Verde Islands; Senegal; islands of the Pacific and Indian oceans. Porto Rico: Mayaguez, on coral reef; Puerto Real; Playa de Ponce Reef; Ensenada Honda, Culebra; off Vieques, 16 fathoms, station 6092; off Humaçao, 10 fathoms, station 6097; San Juan (G. M. Gray, coll.).

Family PORTUNIDÆ Leach, 1819; Miers, 1886.

Carapace depressed, moderately transverse, and usually widest at the last antero-lateral marginal spine. Front horizontal. Orbits and eye-stalks of moderate length. Lateral teeth usually from five to nine. Last trunk legs usually adapted for swimming, with terminal joint ovate, flatly expanded.

Key to the Porto Rican genera of the family Portunidæ.

A. Movable portion of antennæ not excluded from orbit.
B. A longitudinal ridge on the palate.
C. Outer maxillipeds not remarkably advanced; segments of palp subcylindrical.
D. Abdomen of male triangular..*Portunus*
D′. Abdomen of male ⊥-shaped..*Callinectes*
C′. Outer maxillipeds remarkably advanced; last two segments of palp compressed and lamellate..............*Lupella*
B′. No longitudinal ridge on the palate..*Arenæus*
A′. Movable portion of the antenna excluded from orbital cavity by a prolongation of basal joint of antenna..*Charybdella*

Genus PORTUNUS Fabricius.

Portunus Fabricius, Entom. Sys., Suppl., 325, 1798.
Lupa Leach, Edin. Encyc., VII, 390, 1814. (Not *Lupa* de Haan, 1833.)
Lupania Rafinesque, Amer. Monthly Mag., III, 272, Aug., 1818.
Neptunus de Haan, Fauna Japon., pp. 3 and 7, 1833.

Carapace transverse, usually broad, and depressed or little convex, often with surface areolated. Front proper well delimited from inner supra-orbital angles and cut into from three to six—usually four—teeth; its breadth is from a sixth to a fifth the greatest breadth of carapace (lateral epibranchial spines not included). Antero-lateral borders oblique, arched, longer than postero-lateral, cut into nine teeth (including outer orbital angle), of which the ninth may be enlarged. The orbit usually has two fissures or sutures in upper border, which border is less prominent than lower border, so that the orbit very often has a dorsal inclination; the lower border has a fissure or suture near the outer angle, inner angle dentiform and usually very prominent. The antennules fold transversely. The basal antennal joint is peculiarly short and has its antero-external angle produced to form a lobule or spine extending into the orbit; the flagellum, of moderate length, stands in orbital hiatus. Epistome short or even linear, sometimes prolonged in middle line to form a spine lying below interantennulary septum. Buccal cavity squarish, broader than long, efferent branchial channels almost always well defined. Palpus of outer maxillipeds subcylindrical. Chelipeds longer, usually much longer than any of legs, and massive; arm with spines; both inner and outer angles of wrist spiniform; palm prismatic, costate, and usually with spines, fingers usually nearly as long as the palm and strongly toothed. Ambulatory legs compressed; in last pair merus and carpus are short and broad; propodus and dactylus typically foliaceous and paddle-like for swimming. Abdomen of male triangular, five-jointed, the third, fourth, and fifth segments being fused; the first segment in both sexes is almost entirely concealed beneath carapace.

Key to the Porto Rican subgenera and species of the genus Portunus.

A. Carapace wide; antero-lateral margin the arc of a circle with long radius, whose center is near posterior margin of carapace..Subgenus *Portunus*
B. First eight lateral spines or teeth subequal..*ventralis*
B′. Second, fourth and sixth lateral spines or teeth smaller than the others..*sulcatus*
A′. Carapace narrow; antero-lateral margin the arc of a circle with short radius, whose center is near center of cardiac region..Subgenus *Achelous*
B. Carapace with rounding posterior corners.
C. No spine on the basal joint of swimming feet.
D. Superior outer surface of manus with a longitudinal tuberculated ridge.
E. Frontal teeth six (exclusive of the inner orbital)..*spinimanus*
E′. Frontal teeth four (exclusive of inner orbital)..*depressifrons*
D′. Superior outer surface of manus iridescent, and without a longitudinal tuberculated ridge..............*ordwayi*
C′. An erect spine on the basal joint of swimming feet..*sebæ*
B′. Carapace with sharp posterior angles..*spinicarpus*

Subgenus PORTUNUS.

Carapace very wide, the antero-lateral margin being the arc of a circle with long radius, whose center is near posterior margin of carapace. Last spine of antero-lateral margin usually much larger and longer than the others.

Portunus ventralis (A. Milne Edwards).

Neptunus ventralis A. Milne Edwards, Crust. Rég. Mex., 215, pl. XL, f. 3, 1879.

Carapace of moderate width, very uneven, covered with a short pubescence, out of which arise the granulations of the elevated portions of carapace. Front slightly advanced. The two middle teeth are smaller than the lateral; the projection from epistome is visible between them; inner orbital angles blunt. Antero-lateral teeth small, widely separated, very granulous at base, their points directed more forward than usual. Lateral spine as long as the space occupied by the three last teeth and directed obliquely backward. Pterygostomian regions covered with hairs, which conceal the granulations. Merus of outer maxillipeds little advanced and bordered on front and sides with a prominent margin. Merus of chelipeds with four anterior spines and a posterior distal spine; carpus with an inner and an outer spine; three spines on manus, one next the carpus, the others on upper margin at distal and near distal end. Ambulatory legs short. Merus of swimming feet without a spine.

Dimensions of male: Entire length, 15 mm.; entire width, 30 mm.; width at sinus in front of lateral spines, 23.7 mm.

Guadeloupe (type locality). Porto Rico: Mayaguez; off Puerto Real, 8½ fathoms, station 6074; Boqueron Bay; Ponce reefs; Ensenada Honda, Culebra.

Portunus sulcatus (A. Milne Edwards).

Neptunus sulcatus A. Milne Edwards, Crust. Rég. Mex., 216, pl. XXXIX, f. 3, 1879.

Very similar to *P. ventralis*. Carapace more even. Second, fourth, and sixth teeth noticeably smaller than the others; the lateral spine curves forward.

Dimensions of female (one of type lot): Entire length, 10.5 mm.; entire width, 21.2 mm.; width at sinuses in front of lateral spine, 15.7 mm.

Coast of Brazil, lat. 11° 49′ S., long. 37° 27′ W., 12 to 17 fathoms, *Hassler* (type locality); Cape Frio, Brazil (Copenhagen Mus.); off Georgia and northern Florida (Copenhagen Mus.); Gulf of Mexico and Caribbean Sea, at the surface. Mayaguez, Porto Rico, 1 young male.

Subgenus ACHELOUS de Haan.

Achelous de Haan, Fauna Japon., pp. 3 and 8, 1833.

Carapace narrow, the antero-lateral margin being the arc of a circle with short radius, whose center is near center of cardiac region. Last spine of antero-lateral margin usually not much if any larger than the others.

Portunus (Achelous) spinimanus Latreille.

Portunus spinimanus Latreille, Nouv. Dict. Hist. Nat., XXVIII, 47, 1819.
Portunus (Achelous) spinimanus de Haan, Fauna Japon., 8, 1833.
Achelous spinimanus A. Milne Edwards, Crust. Rég. Mex., 230, pl. XXXIX, f. 2, 1879.

Carapace pubescent, sculptured, the raised parts covered with granulations. The nine teeth of antero-lateral borders are about equal except the last, which in the old surpasses the others a little, and in the young is considerably longer. Inner orbital angles bifid; the median teeth of the front are more advanced than the others. All the frontal teeth are acute. Merus of outer maxillipeds very long and slightly excavate for articulation of palpus. Chelipeds strongly developed in adult male; arm with four spines in front and one behind; wrist and hand armed with two spines each. Hand elongate, with five tuberculated ridges on outer and upper surface. Merus of swimming feet short, wide, and unarmed.

Dimensions of male: Length to sinus, 52.5 mm.; extreme length, 54.2 mm.; extreme width, 90 mm. This is the largest of the West Indian species of this genus.

From Virginia to Rio de Janeiro, Brazil; Gulf of Mexico; Bermudas (Rankin). Porto Rico: Mayaguez; Mayaguez Harbor, 7 fathoms, station 6059; Boqueron Bay; Puerto Real.

Portunus (Achelous) depressifrons Stimpson.

Achelous depressifrons Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 223, 1860; A. Milne Edwards, Crust. Rég. Mex., 230, pl. XL, f. 4, 1879.

Carapace convex behind and in the median region, but flattened toward the anterior and lateral borders. Width about 1.5 times the length. Surface rugose and pubescent. Antero-lateral border ciliated; teeth equal, the last scarcely longer than the next. Front very little produced; median part divided into four almost equal teeth. Inner orbital tooth simple. Superior border of orbit cut by two fissures. Chelipeds triangular prismatic, pubescent; arm ciliated and armed with five spines in front and a spine at its outer extremity. Carpus slender, provided inside with a slender, sharp spine and a smaller spine on outside. Hand remarkably short and compressed, a raised crest above, a spine near wrist and another near finger; surface finely scabrous. Finger surmounted by a border of hairs. Ambulatory legs slender; those of first pair ciliated below; those of second and third pairs smooth; last pair much shorter than third.

Carapace speckled and marbled with grayish purple, more brilliant toward middle; a dark median spot on the intestinal region; hairs of fingers of the chelipeds red, denticulations carmine (A. Milne Edwards). Of the six specimens taken by the *Fish Hawk* and preserved in alcohol, two, a male and a female, have much darker carapace than the others. In these as well as in a smaller light-colored specimen, the ambulatory legs of first pair are much darker than the other legs; fringe of hair on their lower and anterior edge crimson. Similar hairs border the inner margin of the carpus and the upper margin of the dactylus of the chelipeds; prehensile teeth also crimson.

Dimensions of male: Entire length, 24.7 mm.; entire width, 39.7 mm.

South Carolina; Bahamas; Florida Reefs; Caribbean Sea; Bermudas. Culebra (*Fish Hawk*).

Portunus (Achelous) ordwayi Stimpson.

Achelous ordwayi Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 224, 1860.
Neptunus ordwayi A. Milne Edwards, Crust. Rég. Mex., 217, pl. XL, f. 2, 1879.

Carapace narrow. Surface pubescent, and with rounded granulations on raised portions and near lateral borders. Front much advanced, rather narrow, and with four narrow teeth besides the sharp orbital angles; the median exceed a little the lateral, which are turned slightly outward. Orbits large, their superior border very concave. Of the antero-lateral teeth the first are wider at base than the last; the ninth is twice as long as the preceding in full-grown specimens, and its point is curved forward a little. Postero-lateral borders short and very concave. The epistomial spine does not exceed the front. Merus of outer maxillipeds strongly narrowed forward, its inner angle cut obliquely for insertion of palpus. Chelipeds small, but armed with very sharp spines; on the margins are long hairs which nearly conceal the spines. The arm has four spines in front and one behind, the wrist with one long spine inside and a small spine outside; hand surmounted with two spines, one above articulation with the preceding article, the other near anterior third of upper margin. This margin is in the form of a raised carina. Three other carinæ on outer surface of palm. Fingers narrow and channeled. The ambulatory feet are compressed and have very long and styliform dactyli. Sternal plastron rugulose, as are also the first segments of the abdomen.

Red or pale brown in dots; gastric region usually very deep crimson. Some mother-of-pearl reflections especially noticeable on the upper surface of the hands (A. Milne Edwards).

Length of female, to sinus, 25 mm.; extreme length, 26.2 mm.; extreme width, 40.3 mm.

Bahamas; Florida Straits; Gulf of Mexico; Antilles; Abrolhos Islands, Brazil; Bermudas. Porto Rico: Mayaguez; off Culebra, 14¾ fathoms, station 6086; off Vieques, 16 fathoms, station 6092; off Humacao, 12½ fathoms, station 6098.

Portunus (Achelous) sebæ (Milne Edwards).

Lupea sebæ Milne Edwards, Hist. Nat. Crust., I, 455, 1834.
Neptunus sebæ A. Milne Edwards, Arch. Mus. Hist. Nat. Paris, X, 329, pl. XXVIII, f. 2, 1861.

Carapace convex in middle, sloping gradually down to lateral margins. Width, exclusive of spines, about 1.5 times length. Antero-lateral teeth sharp, tips turned forward, lateral spine longer than the space occupied by the three next teeth. Of the four frontal teeth, the median pair are blunt, more advanced than the second pair, which are acute. The inner orbital tooth is also acute, its outer margin sinuous. Merus of chelipeds with five anterior spines and one posterior subterminal spine. Carpus with a long inner spine and a short outer one. Manus compressed, with a long spine at articulation with carpus, and two superior spines, one of which is terminal and one at distal third of upper margin. Ambulatory legs narrow; swimming feet with an erect spine on basal joint (peculiar to this species); merus with a posterior distal spine.

On either side of carapace near middle of postero-lateral margin there is a large circular red spot.

Dimensions of male: Entire length, 29.5 mm.; entire width, 55.2 mm.; width at sinus in front of lateral spine, 42.5 mm.

North Carolina; Gulf of Mexico; Antilles; Brazil; Bermudas. Puerto Real and Boqueron Bay, Porto Rico.

Portunus (Achelous) spinicarpus Stimpson.

Achelous spinicarpus Stimpson, Bull. Mus. Comp. Zool., II, 148, 1871.
Neptunus spinicarpus A. Milne Edwards, Crust. Rég. Mex., 221, pl. XL, f. 1, 1879.

Carapace narrow, slightly pubescent, surface uneven. Antero-lateral teeth very sharp and slender. Lateral spine very long and slender, about half the length of lateral border. Front slightly advanced, teeth small, sharp, triangular; median surpassing a little the lateral. A notch in inner orbital tooth above flagellum. Postero-lateral angles sharp. Chelipeds long and feeble. Merus armed in front with four large spines, a fifth spine at end of posterior margin. Wrist with an unusually long spine, reaching anterior third of the hand, or even beyond end of palm. Palm with only two small spines. Swimming feet large and strong, merus with infero-distal angle spinulous. Sternum finely granulate; abdomen smooth.

Dimensions of male: Length to sinus, 20.5 mm.; extreme length, 21.2 mm.; extreme width, 45.2 mm.; width to sinus in front of lateral spine, 32.5 mm.

From North Carolina to Sabanilla, United States of Colombia, and Trinidad, 13 to 150 fathoms. Mayaguez Harbor, Porto Rico, 75 to 76 fathoms, station 6063.

Genus CALLINECTES Stimpson.

Callinectes Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 220, 1860.

The genus *Callinectes* is opposed to *Portunus* by having the abdomen of the male very narrow, ⊥-shaped, and the merus of the outer maxillipeds strongly produced outwardly at antero-external angle. The different species also agree in having strong antero-lateral teeth, the last being considerably stronger than the others, and in the stout chelipeds, the manus having five external costæ and not more than two teeth or spines.

Key to the Porto Rican species of the genus Callinectes.

A. Frontal teeth two (excluding the inner orbital) .... *sapidus acutidens*
A′. Frontal teeth four (excluding the inner orbital).
  B. Appendages of first abdominal segment of male much shorter than abdomen.
    C. Lateral spine more than twice the length of preceding tooth.
      D. Intramedial region broad, its anterior width about three times its length .... *ornatus*
      D′. Intramedial region narrow, its anterior width about twice its length.
        E. Appendages of first abdominal segment of male greatly exceeding third segment .... *danæ*
        E′. Appendages exceeding third segment but little, or not at all .... *marginatus*
    C′. Lateral spine less than twice the length of preceding tooth .... *exasperatus*
  B′. Appendages reaching the extremity of abdomen .... *bocourti*

Callinectes sapidus acutidens Rathbun.

Callinectes sapidus acutidens Rathbun, Proc. U. S. Nat. Mus., XVII, 354, pls. XIII and XIV, f. 2, 1895.

Carapace moderately convex. Granules prominent, crowded on inner branchial and cardiac regions, more scattered on anterior half of carapace. Length of intramedial region about one-half its anterior width. A transverse granulate ridge on protuberant cardiac lobes. Two triangular frontal (interantennal) teeth, each having on its inner margin a low ill-defined tooth whose outer margin is transverse. Subfrontal and suborbital spines acuminate. Lateral teeth broad at base, narrowing abruptly to long, acuminate tips; margins granulate. Last two teeth very long; lateral spine more than three times the length of preceding tooth. Penultimate segment of abdomen of male much constricted in its proximal half, widening at both extremities. Terminal segment obtuse, lateral margins convex proximally, slightly concave or straight distally. Appendages of first segment reach nearly to or beyond extremity of abdomen, near together for their proximal half, with only a slight outward curve; distal portions widely divergent except at tips. Abdomen of adult female very broad, margins of last three segments separately convex; terminal segment longer than wide. Costæ of cheliped very prominent and strongly granulate. The granules of inner margin of merus extend upon upper surface of distal half. Two carpal spines, one at outer angle and a shorter one close to propodal spine.

Length of male, 49 mm.; total length, 50.8 mm.; width, 121 mm.; length of lateral spine, 16 mm.; of preceding tooth, 5 mm.

Santa Cruz and Rio de Janeiro, Brazil; Escondido River and Greytown, Nicaragua; St. Johns River, Palatka, Florida; Lake Palourde, Morgan City, Louisiana (not typical). Porto Rico: Arroyo, 1 young male; Mayaguez Harbor, 7 fathoms, station 6059, 1 adult female, without chelipeds.

Callinectes ornatus Ordway.

Callinectes ornatus Ordway, Boston Journ. Nat. Hist., VII, 571, 1863. Rathbun, Proc. U. S. Nat. Mus., XVIII, 356, pls. XV; XXIV, f. 3; XXV, f. 2; XXVI, f. 2; XXVII, f. 2, 1895.

Carapace rather convex; depressions shallow; length of intramedial area much less than half its anterior width. Surface finely and rather evenly granulated. Frontal (inter-antennal) teeth four, the two outer obtuse, margins slightly concave; inner teeth small. Subfrontal tooth a prominent spine. Suborbital tooth a broad arcuate lobe. Lateral teeth shallow and broad; margins convex at base, concave in terminal half; posterior margins longer than anterior; tips acute in first five or six teeth, acuminate in remainder. Lateral spine about 2.5 times preceding tooth, directed forward. Abdomen of male with penultimate segment widest at proximal end, its margins slightly concave. Appendages reach middle of penultimate segment; proximally they curve inward and touch or overlap each other; distal portions straight and divergent, widening a little behind slender tip. Abdomen of female very broad at proximal end, tapering more rapidly to terminal segment than in any other species.

Dimensions of male: Length to sinus, 49 mm.; entire length, 51 mm.; width, 105 mm.; length of lateral spine, 10.6 mm.; of preceding tooth, 4 mm.

South Carolina to Victoria, Brazil; Bermudas. Porto Rico: Mayaguez; Mayaguez Harbor, 7 fathoms, station 6059; Boqueron Bay; Puerto Real; Guanica; Playa de Ponce; Arroyo; Ensenada Honda, Culebra; Hucares; Fajardo.

Callinectes danæ Smith.

Lupa diacantha Dana, Crust. U. S. Expl. Exped., I, 272, 1852; pl. XVI, f. 7, 1855.
Callinectes danæ Smith, Trans. Conn. Acad. Sci., II, 7, 1869. Rathbun, Proc. U. S. Nat. Mus., XVIII, 357, pl. XVI; XXIV, f. 4; XXV, f. 3; XXVI, f. 3; XXVII, f. 3, 1895, and synonymy.

Intramedial region narrow. Front with two distinct median teeth, small, subacute; lateral teeth narrow, acute. Of the antero-lateral teeth of carapace, the second to sixth, inclusive, do not trend forward, posterior margin of each tooth not much longer nor more convex than anterior; all teeth acute, the seventh and eighth especially so; eighth tooth directed forward. Lateral spine more than three times length of preceding tooth. Suborbital tooth rather long and narrow. Penultimate segment of abdomen of male very broad at proximal end. The appendages reach to middle or beyond middle of penultimate segment and taper regularly to tips; they sometimes touch each other proximally, but more often are separated. Abdomen of female similar to that of *C. ornatus*, but wider in its fifth and sixth segments. Costæ of chelipeds very closely set with fine granules interspersed with larger ones.

Length to sinus, 55.5 mm.; greatest length, 57.5 mm.; width, 131.5 mm.; length of lateral spine, 16.3 mm.; of preceding tooth, 4.5 mm.

From Indian River Inlet, Florida, to Brazil. Porto Rico: San Juan; Rio Bayamon, above Palo Seco; Mayaguez; Mayaguez Harbor, 7 to 7¼ fathoms, stations 6058 and 6059; Hucares; Arecibo (C. W. Richmond, coll.).

Callinectes marginatus (A. Milne Edwards).

Neptunus marginatus A. Milne Edwards, Arch. Mus. Hist. Nat. Paris, X, 318, pl. XXX, f. 2, 1861.
Callinectes larvatus Ordway, Boston Jour. Nat. Hist., VII, 573, 1863. Rathbun, Proc. U. S. Nat. Mus., XVIII, 358, pl. XVII; XXIV, f. 5; XXV, f. 4; XXVI, f. 4; XXVII, f. 4, 1895.
Callinectes marginatus Rathbun, Proc. Biol. Soc. Washington, XI, 149, 1897, and synonymy.

Areolations well marked; granules coarse; length of intramedial area a little less than half its anterior width. Front four-toothed; median teeth small, more prominent than in *C. ornatus;* lateral teeth obtuse, broader and more arcuate than in *C. ornatus*. Suborbital tooth prominent, arcuate, curved upward. Antero-lateral margin little arched; teeth well separated by deep rounded sinuses; the second to fifth, inclusive, have convex posterior margins; first three or four teeth obtuse, the remainder sharp. Lateral spine between 2 and 2.5 times the length of preceding tooth. Terminal portion of abdomen of male slender; penultimate segment wider at proximal than at distal end, margins slightly concave; appendages very short, overreaching third segment but little, or not at all. Abdomen of female much narrower than in any other species; terminal segment much longer than wide. Costæ of manus prominent, with medium granules.

Dimensions of male: Length to sinus, 43.5 mm.; entire length, 44.5 mm.; width, 96.5 mm.; length of lateral spine, 9.5 mm.; of preceding tooth, 4 mm.

Florida Keys and Bahama to Bahia, Brazil; west coast of Africa, from Cape Verde Islands to St. Paul de Loanda. Porto Rico: San Antonio Bridge, San Juan; Mayaguez; Puerto Real; reefs at Ponce; Ensenada Honda, Culebra; Hucares; Fajardo.

Callinectes exasperatus (Gerstaecker).

Lupea exasperata Gerstaecker, Arch. f. Natur., XXII, pt. 1, 129, 1856.
Callinectes tumidus Ordway, Boston Jour. Nat. Hist., VII, 574, 1863. Rathbun, Proc. U. S. Nat. Mus., XVIII, 359, pl. XVIII; XXIV, f. 6; XXV, f. 5; XXVI, f. 5; XXVII, f. 5, 1895.
Callinectes exasperatus Rathbun, Proc. Biol. Soc. Washington, XI, 150, 1897.

Carapace very convex; depressions deep; length of intramedial area no more than half its anterior width. Frontal teeth four, triangular, tips rounded, the two median large and prominent, but not so far advanced as lateral. Submedian tooth short, exceeding the front but little. Suborbital lobe rounded. Antero-lateral margin very arcuate; teeth broad, the first six very convex on posterior margins and obtuse, the next two acute; of the eight teeth, the fifth is the largest; the sixth and seventh next in size. Lateral spine less than twice the length of preceding tooth. Penultimate segment of male abdomen similar in shape to that of *C. ornatus*, but much shorter; appendages reaching to about middle of penultimate segment, tips incurved. In the abdomen of the female the penultimate segment is shorter than fifth and its margins are very arcuate. Spine at distal end of merus and carpal spine are almost obsolete, being replaced by blunt prominences. A blunt tooth on anterior margin of the carpus just below inner angle. Costæ of manus coarsely and sparingly tuberculate.

Dimensions of male: Length to sinus, 61.5 mm.; entire length, 63.6 mm.; width, 118.5 mm.; length of lateral spine, 7.9 mm.; length of preceding tooth, 5 mm.

Florida Keys to Rio de Janeiro, Brazil. Porto Rico: San Antonio Bridge, San Juan; Cataño, San Juan Harbor; Rio Bayamon, above Palo Seco; Mayaguez; Puerto Real; Hucares.

Callinectes bocourti A. Milne Edwards.

Callinectes bocourti A. Milne Edwards, Crust. Rég. Mex., 226, 1879 (var. of *Callinectes diacanthus*). Rathbun, Proc. U. S. N. M. XVIII, 360, pl. XIX; XXIV, f. 7; XXV, f. 6; XXVI, f. 6; XXVII, f. 6, 1895. Proc. Biol. Soc. Washington, XI, 151, 1897.

Very convex; areolations prominent; coarsely granulate, except along lateral margin, where the carapace is smooth. Intramedial region very long, its length about equal to its posterior width. Front with four large rounded teeth, the median the smaller and a little less advanced or quite as advanced as lateral. Suborbital tooth short, triangular, narrow, obtuse. Antero-lateral teeth very broad, acute, the last two or three spiniform. Lateral spine short, usually less than twice the length of preceding tooth. Penultimate segment of abdomen in male constricted in its proximal portion, widening at both extremities; terminal segment long; appendages reaching to end of abdomen, with a double curve; tips crossing. The sternum has a deep longitudinal groove in front of abdomen. Abdomen of female very long, especially the penultimate segment; terminal segment much longer than wide. Costæ of chelipeds with depressed granules, often appearing to the eye almost smooth. Carpal and distal meral spine usually normal, though sometimes in old specimens reduced to blunt projections. A broad, blunt tooth on anterior margin of carpus just below inner angle.

Dimensions of male: Length to sinus, 69.5 mm.; entire length, 72.5 mm.; width, 140 mm.; length of lateral spine, 10 mm.; length of preceding tooth, 7 mm.

Barbados; Honduras to Rio de Janeiro; west coast of Africa from Senegal to Chinchoxo.

Porto Rico: Cataño, San Juan Harbor; Rio Bayamon, above Palo Seco; Aguadilla; Mayaguez on coral reef; Hucares.

Lupa diacantha, recorded by Gundlach, represents one or more species of *Callinectes;* common name "Jaiba" (Gundlach).

Genus LUPELLA Rathbun.

Lupa de Haan, Fauna Japon., 11, 1833. (Not *Lupa* Leach, 1814.)
Lupella Rathbun, Proc. Biol. Soc. Washington, XI, 155, 1897.

Closely allied to *Portunus*. Inner suborbital angle remarkably prominent and firmly united with a prolongation from basal joint of antenna. Outer maxillipeds extend far beyond front; merus rounded in front, its outer angle obtuse and strongly produced; last two segments of palpus flattened and laminate. Abdomen of male narrow, third segment narrowing rapidly toward distal end. Transverse sutures of posterior half of sternum interrupted either side of abdomen, under which they do not pass. Median suture of sternum crosses the four posterior segments.

Lupella forceps (Fabricius).

Cancer forceps Fabricius, Ent. Sys. auct. et emend., II, 449, 1793.
Lupa forceps Leach, Zool. Misc., I, 123, pl. LIV, 1814.

Carapace flat, hexagonal, finely granulate. Epigastric and epibranchial lines rather well marked. Posterior margin very wide. Antero-lateral margin armed with eight very small, sharp teeth, separated by wide sinuses; lateral spine long, slender, and extending directly outward. The front (between antennæ) is four-toothed, middle pair small and subacute, outer pair longer and obtuse. Inner orbital teeth broad, obtuse; epistomal tooth short, not surpassing the front. Chelipeds smooth and remarkably long and slender; the arm equals width of carapace near base of lateral spines, hand twice as long. Anterior border of arm with four to six spines; posterior border with a spine at extremity. Wrist with a spine at inner angle, another on outer surface. Hand cylindrical, slender, with a spine above articulation with carpus and another above articulation with dactylus. Fingers very slender, almost filiform, with numerous small teeth on their occludent edges. Ambulatory legs very compressed; merus of swimming pair short, almost orbicular, armed above and below with a terminal spine; propodus elongate; dactylus oval. In young males the fingers are shorter, and in females still shorter.

Dimensions of male: Length of median sinus, 19 mm.; extreme width, 48.4 mm.; width at sinus, between lateral spine and next tooth, 33.5 mm.

West Indies. Uncommon. Porto Rico: San Juan Harbor, between Palo Seco and Cataño; Mayaguez, in seine; Mayaguez Harbor, 7 to 7½ fathoms, stations 6058 and 6059; off Puerto Real, 8½ fathoms, station 6074; Mayaguez and San Juan (Gundlach).

Genus **ARENÆUS** Dana.

Arenæus Dana, Am. Jour. Sci. (2), XII, 130, 1851.

Closely allied to *Portunus*, with which it is sometimes united. Differs in having the palate smooth or without a longitudinal ridge. Superior fissures of orbit open, V-shaped. Abdomen in male narrower than in typical *Portunus*, yet not ⊥-shaped as in *Callinectes*.

Arenæus cribrarius (Lamarck).

Portunus cribrarius Lamarck, Hist. Nat. Anim. sans Vert., V, 259, 1818.
Arenæus cribrarius Dana, Crust. U. S. Expl. Exped., I, 290, 1852; pl. XVIII, f. 2, 1855.

Carapace wide and almost smooth to the naked eye, but through the lens it appears closely covered with fine granulations. Front narrow, much less advanced than outer orbital angles and armed with six teeth (between the orbits), the two median more prominent than intermediate ones, which are partly coalesced with median; outer pair obtuse, wide, and separated from preceding by a wide cut. Superior border of orbit divided into three lobes by two wide incisions; inferior orbital border much advanced at inner end. Antero-lateral teeth wide and covered below with hairs which screen the interspaces; the first narrower than the last; lateral horn strong, pointed, and a little longer than space occupied by two last teeth. Inferior orbital border interrupted by a wide external fissure. Pterygostomian regions, epistome, and antennal region covered with hairs. Endostome smooth. Merus of outer maxillipeds narrowing much distally. Chelipeds short. Three spines arm the merus in front; one spine, almost tuberculiform, is at a little distance from end on posterior border. Wrist with two spines, one inside, the other out. Hand short and swollen, crossed by granulous carinæ and surmounted by two short spines, one above articulation with wrist, the other above movable finger. Ambulatory feet not long, their last articles very wide. Swimming feet very stout, the merus somewhat rounding and unarmed. Sternum smooth, abdomen of male triangular, margins a little sinuous, last article very pointed.

Carapace and chelæ violet or yellowish brown, covered with a multitude of round spots, either white or light yellow (A. Milne Edwards). These spots are present in alcoholic specimens.

Dimensions of male: Length to median sinus, 44.5 mm.; length to tip of median pair of teeth, 46.2 mm.; entire width, 103.6 mm.; width to sinus in front of lateral spine, 80.5 mm.

From New Jersey to Rio de Janeiro; Gulf of Mexico. Porto Rico: San Juan Harbor at Palo Seco and between Palo Seco and Cataño; Mayaguez; Boqueron Bay; Playa de Ponce; Arroyo; Vieques; Aguadilla and San Juan (Gundlach).

Genus CHARYBDELLA Rathbun.

Cronius Stimpson. Ann. Lyc. Nat. Hist. N. Y., VII. 225. 1860.
Charybdella Rathbun, Proc. Biol. Soc. Washington, XI, 166, 1897.

Carapace narrow. Front wide; front proper (excluding the inner orbital angle) six-toothed. Antero-lateral border cut into nine teeth alternately large and small. Basal article of antenna produced into orbital sinus so as to separate flagellum from orbit.

Key to the Porto Rican species of the genus Charybdella.

A. Hand armed with four spines. .... *rubra*
A'. Hand armed with two spines .... *tumidula*

Charybdella rubra (Lamarck).

Portunus ruber Lamarck, Hist. Nat. Anim. sans Vert., V, 260, 1818.
Cronius ruber Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 225, 1860.
Achelous ruber A. Milne Edwards, Arch. Mus. Hist. Nat. Paris, X, 345, pl. XXIII, f. 1, 1861.
Charybdella rubra Rathbun, Proc. U. S. Nat. Mus., XXII, 291, 1900.

Carapace hexagonal, smooth, and pubescent. Front cut into eight teeth, the two median more advanced and larger; directed forward; those of second pair more pointed, directed slightly outward and separated from those of third pair by a deep cut; third pair sharp, directed forward, and not deeply separated from those of fourth pair, which constitute the inner orbital angles and are broad and blunt. Basal article of external antennæ carries a spine below insertion of movable portion. Of the antero-lateral teeth or spines the ninth is scarcely longer than first, third, fifth, and seventh; intermediate spines strikingly smaller. Merus of chelipeds armed in front with from four to six spines of unequal size and at extremity of its posterior border with a very small spine. Wrist with granulous crests, a large spine inside and three small spines on outer face. Hand crossed by granulous carinæ and armed above with four spines alternately placed, two on inner border and two on outer border of upper surface.

The general color is a violet red, more or less marbled; extremity of all the spines black (A. Milne Edwards).

Dimensions of male: Length to sinus, 40 mm.; extreme length, 42.5 mm.; extreme width, 68.8 mm.

Charleston Harbor, S. C., to Brazil; Acapulco; San Salvador, Central America; Panama; West Africa from Cape Verde Islands to Loanda. Porto Rico: San Antonio Bridge, San Juan; San Juan Harbor, in fish trap; Mayaguez; Arroyo.

Charybdella tumidula (Stimpson).

Achelous tumidulus Stimpson, Bull. Mus. Comp. Zool., II, 149, 1871.
Neptunus tumidulus A. Milne Edwards, Crust. Rég. Mex., 218, 1879.
Cronius bispinosus Miers, *Challenger* Rept., Zool., XVII, 188, pl. XV, f. 2, 1886.

Carapace narrower than in *C. rubra*, pubescent, granulated toward margins. Last spine of antero-lateral border half again as long as seventh spine. The small alternate spines diminish in the following order: Second, fourth, sixth, eighth. Front convex, prominent, projecting much beyond level of outer angles of orbits; teeth rounded, the two middle ones being smaller than second pair and most prominent, separated from second pair by a rather broad, shallow sinus; a narrow sinus between second and third pairs. Third pair very slightly separated from inner angle of orbit. The separation of the antennal flagellum from the orbit by a process from the basal joint is not so well marked as in *C. rubra*. Chelipeds rather short; merus armed with three large and one small spine on the front edge; spine of outer extremity of posterior edge of merus almost obsolete. Inner spine of carpus long, reaching a third the length of palm. Only one spine on superior margin of hand; another at articulation of carpus. On the merus joint of posterior pair of ambulatory legs is a denticulated extero-inferior margin, but no spine.

Dimensions of male: Length to sinus, 20 mm.; extreme length, 21 mm.; extreme width, 31.2 mm.

Bahamas; Florida Reefs, 37 to 40 fathoms (Stimpson), to Bahia, Brazil, in shallow water (Miers). Porto Rico: Mayaguez; Mayaguez Harbor; Boqueron; off Vieques, 14 fathoms, station 6085. Small specimens only.

Stimpson's description does not agree in all respects with the above, as his type was only a quarter of an inch wide. In such small specimens the lateral spine is longer and the notch above the antenna is obsolete.

Tribe OXYRHYNCHA or MAIOIDEA.

Carapace narrowed anteriorly and rostrate, with the hepatic regions small, the branchial large. Epistome generally large. Buccal frame quadrate, with anterior margin straight. Nine pairs of branchiæ, with the efferent channels opening at the sides of the endostome. The afferent channels open behind the pterygostomian regions, in front of the bases of the chelipeds. First antennæ longitudinally folded. Third maxillipeds with the fifth joint articulated at the apex or at the front inner angle of the fourth. Genital organs of male inserted at bases of last pair of trunk legs.

Family MAIIDÆ Leach, 1815.

Basal joint of antennæ well developed. Chelipeds usually not a great deal longer or more massive than the other legs.

Key to the Porto Rican genera of the family Maiidæ.

A Basal joint of antennæ extremely slender throughout and usually long. Eyes without orbits and not concealed.
B. Carapace elongate, narrowed in front. External maxillipeds somewhat pediform, with the palp large and coarse, the merus often narrower than ischium. Basal joint of antennæ usually subcylindrical.
C. Rostrum extremely long. Dactyli of ambulatory legs longer than the propodi .... *Stenorynchus*
C'. Rostrum short. Dactyli of ambulatory legs shorter than the propodi .... *Podochela*
B'. Carapace usually subtriangular. External maxillipeds with the merus at least as broad as ischium and the palp small. Basal joint of antennæ flattened or concave ventrally.
C. No postocular spine or tooth .... *Epinus*
C'. A postocular spine or tooth.
D. Eye-stalks long and slender .... *Eucinetops*
D'. Eye-stalks not long and slender.
E. Carapace depressed, the branchial regions considerably flattened posteriorly and laterally, so that their lateral margins are visible from above for nearly their whole length.
F. Postocular spine usually large. Hepatic region rather remote from the eye .... *Collodes*
F'. Postocular spine small. Hepatic region approximating the eye .... *Batrachonotus*
E'. Carapace higher and more convex, branchial regions not remarkably flattened, their lateral margins for the most part invisible in a dorsal view.
F. Rostrum bifid or notched .... *Euprognatha*
F'. Rostrum simple.
G. No spine on upper margin of orbit .... *Anasimus*
G'. A spine on upper margin of orbit .... *Inachoides*
A'. Basal joint of antennæ not extremely slender, often very broad. Eyes with orbits, or capable of concealment.
B. Basal joint of antennæ truncate-triangular. Eyes without true orbits; eye-stalks very short, concealed beneath a supraocular spine.
C. Antennæ concealed beneath the rostrum .... *Epialtus*
C'. Antennæ not concealed beneath the rostrum .... *Acanthonyx*
B' Basal joint broad, usually either extensively produced outward or with 1 or 2 distal spines. Eyes with orbits.
C. Orbits rudimentary, with a large, blunt, cupped postocular process into which the eye is retractile, but is not completely concealed. Eye-stalks short.
D. Carapace oval-oblong .... *Chorinus*
D'. Carapace subtriangular.
E. Carapace armed with spines or prominent tubercles .... *Scyramathia*
E'. Carapace almost smooth .... *Pelia*
C'. Orbits complete, often tubular, completely concealing retracted eye.
D. Meral joints of ambulatory legs with continuous laminate expansions.
E. Carapace very high in middle; height greater than half the width .... *Hemus*
E'. Carapace not high; height less than half the width .... *Thoe*
D'. Meral joints of ambulatory legs without continuous laminate expansions.
E. Fingers spoon-shaped at tips.
F. Carapace suboblong or suboval, very broad in front. Orbits directed forward .... *Pitho*
F'. Carapace subtriangular, narrow in front. Orbits directly obliquely forward.
G. Orbits entire .... *Teleophrys*
G'. Orbits dentate or spined .... *Mithrax*
E'. Fingers acute at tips.
F. Carapace with a series of lateral spines or teeth .... *Stenocionops*
F'. Carapace without a series of lateral spines or teeth.
G. Rostral horns contiguous.
H. Horns long and slender .... *Leptopisa*
H'. Horns short, broad and flat .... *Lissa*
G'. Rostral horns not contiguous.
H. Preorbital spine extremely long .... *Picroceroides*
H'. Preorbital spine not extremely long.
J. Orbits tubular, projecting .... *Macrocœloma*
J'. Orbits with closed fissures, but not distinctly tubular and projecting .... *Microphrys*

Genus STENORYNCHUS Lamarck.

Leptopodia Leach, Zool. Misc., II, 15, 1815. (Not *Leptopodia* Leach, Edin. Encyc., VII, 431, 1814.)
Stenorynchus Lamarck, Hist. Nat. Anim. sans Vert., V, 236, 1818 (part). (Not *Stenorhynchus* Latreille, 1825, nor *Stenorynchus* Milne Edwards, 1834.)

Carapace triangular, longer than broad. Rostrum very slender, flattened, longer than the carapace, its lateral margins spinuliferous. Orbits not defined; postorbital spine small. Eyes short and not retractile. Basal joint of antenna very slender; flagellum for the most part concealed beneath the rostrum. Epistome very large. Ischium of external maxillipeds produced at its antero-internal angle; merus somewhat obcordate, bearing the next joint at its external angle. Abdomen in male six-segmented, in female five-segmented. Chelipeds long and slender, with merus, carpus, and palm subcylindrical; fingers much shorter than palm, inner margins dentate. Ambulatory legs extremely long and slender, especially the dactyli. All the legs spinuliferous.

Stenorynchus sagittarius (Fabricius). *Arrow Crab; Araña del mar.*

Cancer sagittarius Fabricius, Ent. Sys. emend. et auct., II, 442, 1793 (part).
Leptopodia sagittaria Leach, Zool. Misc., II, 16, pl. 67, 1815.
Stenorynchus seticornis Lamarck, Hist. Nat. Anim. sans Vert., V, 237, 1818.
Stenorynchus sagittarius Rathbun, Proc. Biol. Soc. Wash., XI, 158, 1897.

Carapace naked. Length of rostrum varying from slightly longer than carapace to twice as long. Propodus of cheliped usually about 2.6 times the length of dactylus, but varies from 2.5 to 4 times. Ambulatory legs of first pair from 8 to 8.6 times the length of carapace.

Carapace striped with bands of white, brown, and black, which extend backward from median line to posterior margin. Fingers blue, their teeth orange. Spines of rostrum and feet orange red.

Dimensions of male: Length of carapace and rostrum, 45.3 mm.; length of rostrum, 23.2 mm.; width of carapace, 19 mm.

From off Cape Hatteras, North Carolina, to Rio de Janeiro, Brazil; Bermudas; Mediterranean; West Africa. It has been found in depths varying from 2 to 814 fathoms, but occurs usually in less than 50 fathoms. Porto Rico: San Antonio Bridge, San Juan; Mayaguez Harbor, 75 to 76 fathoms, station 6063; off Vieques, 6 fathoms, station 6096.

Genus PODOCHELA Stimpson.

Podochela Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 194, 1860.

Carapace somewhat depressed, elongate; gastric region narrow, swollen. Rostrum arcuate or triangulate, sometimes prolonged in a spine, or very short and bilobed. Eyes with short, stout pedicels, which terminate above in a prominent tubercle; cornea oblique, more projecting above than below. Postorbital tooth remote from eye and either well developed or reduced to a granule. Basal article of antennæ very narrow, longitudinally sulcate in middle. Sternum of male either nearly smooth or deeply channeled between the segments; of female concave, deep, margins elevated, laminate, forming a capsule. Abdomen of male with last two segments, of female with last three segments, coalesced. Chelipeds of moderate length, merus curved, trigonal; palm either slender or dilated. Ambulatory legs slender, subprehensile.

Key to the Porto Rican species of the genus Podochela.

A. Rostrum thick, flat underneath .... *macrodera*
A′. Rostrum thin, hollow underneath .... *riisei*

Podochela macrodera Stimpson.

Podochela macrodera Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 196, 1860; A. Milne Edwards, Crust. Rég. Mex., 191, pl. XXXIV, f. 3, 1879.

Cardiac region depressed, bearing one low tubercle; gastric region with two median tubercles; hepatic region swollen, its tubercle very small; a small tubercle on pterygostomian region. Rostrum short, thick, subtriangular, obtuse, flat above, margins inclined. Basal antennal joint much narrower anteriorly than posteriorly, margins thick and convex, united for anterior third. Sternum of male with smooth convex segments separated by shallow grooves; in front of the abdomen are two white-tipped tubercles. First abdominal segment in male, and first and second in female, with a white median tubercle. Chelipeds of male stout, propodi much dilated, fingers widely gaping. Ambulatory legs of first pair about 2.5 times, of second pair about 1.66 times, of fourth pair about 1.33 times the length of carapace. Propodus of last three pairs scythe-shaped; that is, the distal portion, or that against which the dactylus folds, is curved.

Dimensions of male: Length, 15.2 mm.; width, 11 mm.

Bahamas; Florida Keys; West Indies. Depth, 2 to 14¾ fathoms. Porto Rico: Off Vieques, 14 fathoms, station 6085; off Culebra, 14¾ fathoms, station 6086.

Podochela riisei Stimpson.

Podochela riisei Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 196, pl. II, f. 6, 1860.

Carapace with a cardiac and a gastric spine; a gastric tubercle in front of spine; also a flattened spine on the hepatic region pointing downward. Rostrum hood-shaped, with a median carina. Supraorbital margin thickened. Postorbital tooth small, tuberculate; behind and below it a small tubercle. Basal antennal joint deeply concave, with thin laminate margins, forming a subacute angle anteriorly; broader posteriorly, postero-lateral angle dilated. Pterygostomian ridge laminate. Sternum of male with segments flattened, separated by deep grooves; area in front of abdomen protuberant, bituberculate. Chelipeds in both sexes slender, manus not dilated, fingers in contact. First pair of ambulatory legs much stouter than the others, about 3 times the length of carapace; second, third, and fourth pairs decreasing regularly in length, the second pair a little more than twice, the fourth pair nearly 1.6 times the length of carapace; propodi thickened distally, dactyli slightly curved. Carapace and legs ornamented with tufts of curled hair.

Dimensions of male: Length, 14.6 mm.; width, 11.2 mm.

From Cape Hatteras to Florida Keys; Gulf of Mexico; Bahamas; West Indies; Bermudas. Depth, 3 to 49 fathoms. South of Pernambuco, 30 to 350 fathoms (Miers). Off St. Thomas, 20 to 23 fathoms, station 6079; off Vieques, 6 to 15 fathoms, stations 6091 and 6096 (*Fish Hawk*).

Genus ÆPINUS Rathbun.

Apocremnus A. Milne Edwards, Crust. Rég. Mex., 184, 1878. (Name preoccupied.)
Æpinus Rathbun, Proc. Biol. Soc. Wash., XI, 163, 1897.

Carapace short, wide behind, very narrow in interorbital region. Rostrum short, subtruncate, with a median emargination. Upper orbital border very high; no postorbital angle. Eye peduncles short, with a flat upper surface, a tubercle on anterior margin and another at emargination of cornea. Extremity of basal article of antenna visible at sides of front; its outer distal angle sharp. Merus of maxillipeds somewhat L-shaped, produced at anterior outer angle and posterior inner angle. The last two abdominal segments in male and the last three in female are coalesced. Chelipeds short and feeble. Ambulatory legs short; meral, carpal, and propodal joints thickened in middle; dactyli slender, folding against propodi.

Æpinus septemspinosus (A. Milne Edwards).

Apocremnus septemspinosus A. Milne Edwards, Crust. Rég. Mex., 185, pl. XXXV, f. 5, 1879.
Æpinus septemspinosus Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 254, 1898.

The carapace and feet bear a few hooked hairs. Gastric region very narrow and high; it, as also the cardiac region, is surmounted by a very stout erect spine; a third median spine, shorter and directed backward, is situated on first article of abdomen. Each branchial region carries an erect spine. Two shorter spines directed forward surmount orbital border. The gastric region bears, in front of median spine, three or four small tubercles, one or two median, and one lateral; outside these there is a triangular laminate tooth or spine. Otherwise the surface is smooth. The hepatic region terminates below in a laminate tooth; subbranchial margin dentate. Front very short and formed of two rounded lobes separated by a narrow cut. Antennulary fossettes extend nearly to extremity of front, separated by a partition developed inferiorly in a triangular tooth. Basal article of antenna very deep, with a prominent crest below, which near the anterior end bifurcates, the longer, outer branch continuing to epistome where it terminates in a lobe. Exognath of outer maxillipeds toothed on outer margin. Sternum of male with prominent transverse crests. Abdomen of female pitted, and with a smooth median carina; terminal portion tuberculate. Chelipeds granulate; margins of merus tuberculate; palms slender; fingers gaping slightly in male. Ambulatory legs tuberculate below; dactyli hairy.

Length of carapace of male, 10 mm.; width, 8 mm.

Gulf of Mexico; Florida Straits; Bahama Banks. Depth, 14¾ to 37 fathoms. Off St. Thomas, 20 to 23 fathoms, station 6079; off Culebra, 14¾ to 15¼ fathoms, stations 6086, 6087, 6093; off Vieques, 15 to 21 fathoms, stations 6089, 6091, 6092.

Genus EUCINETOPS Stimpson.

Eucinetops Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 191, 1860.

Carapace oblong. Rostrum small, bifid, little deflexed. Eyes very long, reaching much beyond the margins of the carapace. Orbits small, inclosing only base of eye peduncles; external angle acute, spiniform; superior margin with one fissure, without teeth and spines. Antennular fossæ not deep, round, margins obtuse. Basal article of external antennæ small, armed at external angle with a minute tooth or spine; movable part depressed, first and second articles very broad. Epistome very short or wanting. Buccal cavity very broad anteriorly. Merus of outer maxillipeds longer than broad, outer front angle prominent; palpus swollen at base; exognath reaching beyond endognath anteriorly.

Eucinetops blakiana Rathbun.

Eucinetops blakiana Rathbun, Proc. U. S. Nat. Mus., XIX, 13, 1896.

Antero-lateral margins slightly converging anteriorly, nearly straight. Surface uneven; median regions elevated, hepatic region depressed, separated from branchial by a deep hollow and a marginal sinus. Antero-lateral margin tuberculate, a spine at postero-lateral angle; a few additional tubercles on upper surface of branchial region. Front depressed, with two rounded lobes, tipped with a small, sharp spine and separated by a V-shaped sinus. Outer orbital tooth longer than broad, acute, upturned, separated from upper margin of orbit by a narrow, rounded sinus. Eye-stalks filling orbit, tapering to near cornea; tip slightly enlarged. Antero-external lobe of first movable joint of antennæ moderately developed, not reaching end of rostrum. Abdomen composed of seven free segments in both sexes; in the male constricted at fifth segment; sixth segment with convex lateral outlines; seventh rounded, broader than long. Chelipeds small, smooth, and shining; merus subtrigonal; carpus with a tubercle above, near merus; hands compressed, margins converging toward fingers. Ambulatory legs subcylindrical; dactyli very slender and much curved. Carapace and ambulatory legs clothed with hair.

Length of female, 6.4 mm.; width, 4.6 mm.

Arroyo; one immature female. This specimen differs from the types in having a small spine at outer angle of basal joint of antennæ. In the types the tooth at that angle is more strongly developed in the male than in the two adult females. Port Royal, Jamaica (type locality); Bahama Banks.

Genus COLLODES Stimpson.

Collodes Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 193, 1860.

Carapace ovate-triangulate. Rostrum short, entire or bifid. Postorbital process large, triangular, separated from supraorbital arch by a deep, open, marginal fissure. Eyes of moderate length, partially retractile. Basal joint of antenna with a terminal tooth or spine and two margins more or less dentate, the inner margin in a plane at right angles to the outer; flagellum longer than rostrum. Merus of outer maxillipeds obcordate, deeply cut on distal margin, strongly produced at outer and inner angles. Chelipeds of moderate length; merus trigonal, curved. Ambulatory legs of moderate length, the first pair a little more than twice the length of carapace; second pair about the same length as first, sometimes longer; third pair usually shorter than either; fourth pair the shortest. Dactyli styliform, capable of being folded against penultimate joints, and so forming a sort of anchor by which the animal can attach itself to foreign substances.

Abdomen of male with six, of female with five segments. Surface usually hairy, the hairs collecting and retaining particles of mud; upper surface of legs furnished with curved hairs, lower surface with long, straight hairs or bristles.

Key to the Porto Rican species of the genus Collodes.

A Carapace more or less granulate..*inermis*
A′. Carapace smooth..*levis*

Collodes inermis A. Milne Edwards.

Collodes inermis A. Milne Edwards, Crust. Rég. Mex., 179, 1878 pl. XXXII, f. 1, 1879.

Carapace flattened, coarsely granulate on frontal region, the posterior portion of the carapace including the most protuberant part of cardiac region and the outer and lower portions of the branchial and hepatic regions; a few granules in center of gastric region; otherwise smooth; no spines nor tubercles on median line. Rostrum with two blunt teeth separated by a narrow sinus. Interantennular tooth small. Postorbital tooth subtriangular, anterior margin convex, posterior somewhat concave. Sternum granulate; abdomen nearly smooth, first segment with a median tubercle. Basal joint of antenna narrows anteriorly, its outer margin denticulate; the vertical plate near its inner margin is thick and unarmed, and anteriorly forms a rounded lobe. Chelipeds smooth; palm thick; fingers gaping, irregularly toothed. Ambulatory legs very slender, especially terminal joints.

Length of male, 8.7 mm.; width, 7 mm.

Brazil, lat. 11° 49′ S., long. 37° 27′ W. (type locality); Martinique (Aurivillius). Depth, 8½ to 30 fathoms. Porto Rico: Mayaguez Harbor, 12 to 18 fathoms, station 6061; off Puerto Real, 8¼ fathoms, station 6074.

Collodes levis, sp. nov.

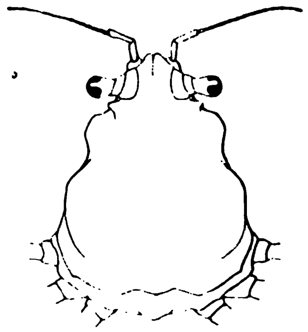

FIG. 9.—*Collodes levis*, female, outline of carapace. × 5.

Carapace narrow, moderately convex, pubescent, smooth, without spines, tubercles, or granules. Rostrum with a median sulcus, margin having a minute emargination forming two small lobes. Interantennular tooth little developed. Postorbital tooth very small for the genus, reaching only about one-third the length of the eye-stalk. The basal antennal joint has the vertical plate along inner margin strongly protuberant anteriorly and entire; outer margin feebly denticulate. Chelipeds feeble, smooth; palm subcylindrical; fingers as long as palm, entire, slightly gaping. Sternum and abdomen smooth, pubescent.

Dimensions of male: Length, 5.4 mm.; width, 4 mm.; ovigerous female, length, 5.5 mm.; width, 4.6 mm.

Off Vieques, 15 fathoms, station 6091; three females, types (Cat. No. 23772). Off Culebra, 14¾ to 15¼ fathoms, stations 6086 and 6087, 1 male, 1 female; off Vieques, 16 fathoms, station 6092, 1 female.

Genus **BATRACHONOTUS** Stimpson.

Batrachonotus Stimpson, Bull. Mus. Comp. Zool., II, 122, 1871; A. Milne Edwards, Crust. Rég. Mex., 180, 1878.

Carapace triangular, broadly expanded behind, especially in male; surface rough with granulations; gastric, cardiac, and branchial regions strongly protuberant; cervical depressions deep and broad, giving carapace a superior outline much like that of a frog's back. Rostrum very short, scarcely projecting beyond the walls of antennulary fossæ, slightly emarginated at the middle. Basal joint of antennæ with dentate margins and a small tooth or spine at anterior extremity. Postorbital spine small, close to eye. Merus of outer maxillipeds broad, with prominent outer and inner front angles. Last two segments of abdomen in male and last three in female anchylosed. Ambulatory legs of first pair very long in male, more than twice as long as those of second pair; posterior pairs very short. In the female all the ambulatory legs are short. Dactyli rather long.

This genus is very closely allied to *Collodes*, from which it differs chiefly in its carapace, broader posteriorly, its smaller postorbital tooth, in shape of the hepatic region, which is angular in outline instead of rounded, the anterior margin being at right angles to median line, in the merus of the maxillipeds, which has the inner lobe more produced and transverse than in *Collodes*, and in the great length of the first ambulatory legs of the male.

Key to the Porto Rican species of the genus Batrachonotus.

A. Regions surmounted by a spine .... *fragosus*
A′. Regions not surmounted by a spine .... *brasiliensis*

Batrachonotus fragosus Stimpson.

Batrachonotus fragosus Stimpson, Bull. Mus. Comp. Zool., II, 122, 1871.

Male: Carapace coarsely tuberculate, especially on protuberant portions. Cardiac, gastric, and branchial regions each surmounted by a stout spine. First segment of abdomen with a spine. Two large tubercles on intestinal region just above posterior margin, and many tubercles on the margin of the branchial region; also a short spine on subhepatic and on pterygostomian region. Rostrum formed of two rounded lobes separated by a shallow notch; its margin and the supraorbital margin denticulate. Abdomen and sternum granulate, except for a transverse smooth area between bases of chelipeds.

Chelipeds a little longer than carapace, spinulous; ischium with a distal spine; manus slightly compressed; fingers nearly as long as the palm, gaping for nearly their whole length, a large tooth in middle of pollex.

Females smaller, narrower behind and wider in front than males, tuberculation of carapace more uniform, cardiac area devoid of a spine, intestinal region without large tubercles. First ambulatory leg very little longer than the second, about 1.5 times length of the carapace. Abdomen tuberculate or granulate.

Dimensions of male: Length, 7.8 mm.; width, 7 mm.

Off Cape Hatteras to Florida Straits and Gulf of Mexico in a depth of 9½ to 30 fathoms. Off St. Thomas, 20 to 23 fathoms, station 6079; off Vieques, 14 to 16 fathoms, stations 6085, 6091, 6092; off Culebra, 14¾ to 15 fathoms, stations 6086 and 6093; off Humaçao, 9½ fathoms, station 6098.

Batrachonotus brasiliensis Rathbun.

Batrachonotus brasiliensis Rathbun, Proc. U. S. Nat. Mus., XVII, 54, 1894.

Male: Carapace tuberculate or coarsely granulate on the protuberant portions, smooth between; devoid of spines; two larger tubercles just above the posterior margin and near the median line; also one on the subhepatic and on the pterygostomian region. Otherwise as in *B. fragosus*.

The female differs from male, as in the species *B. fragosus*, in being relatively wider across hepatic regions; the two large tubercles near posterior margin are wanting.

Dimensions of male: Length, 4.5 mm.; width, 4 mm. Female with eggs: Length, 7 mm.; width, 6 mm.

Off Rio de Janeiro, dredged (type locality); San Juan Harbor, Porto Rico, 4½ to 5½ fathoms, station 6054, 1 male. This is the only specimen known except the type.

Genus EUPROGNATHA Stimpson.

Euprognatha Stimpson, Bull. Mus. Comp. Zool., II, 122, 1871.

Carapace pyriform. Rostrum short, with two small teeth or horns. Interantennulary spine usually present, pointing forward and downward at a much lower level than rostrum. Basal antennal joint narrowly triangular, with an outer and an inner granulate or dentate crest; armed at anterior extremity with a slender spine reaching forward as far or nearly as far as do the rostral horns; movable part of antennæ exposed from its insertion. A spine or tubercle on orbital arch. Eye peduncle short, with a tubercle at the emargination of cornea. Postocular spine reaching beyond extremity of eye. Merus of external maxillipeds somewhat L-shaped, strongly produced beyond insertion of palpus in front and at postero-inner angle. Abdomen of male with last two segments coalesced.

Chelipeds with palms dilated; fingers in the male slightly gaping. Ambulatory legs of first pair much the longest, the others decreasing regalarly in length. Dactyli long and slender, more than half the length of propodal joints. These crabs are almost naked, the ambulatory legs with a few curled setæ above.

Key to the Porto Rican species of the genus Euprognatha.

A. Interantennular spine equaling or surpassing the front ....*rastellifera*
A′. Interantennular spine not equaling the front..*gracilipes*

Euprognatha rastellifera Stimpson.

Euprognatha rastellifera Stimpson, Bull. Mus. Comp. Zool., II, 123, 1871; A. Milne Edwards, Crust. Rég. Mex., 183, 1878, pl. XXXIII, f. 2, 1879; Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 253, 1898.
Euprognatha rastellifera spinosa Rathbun, Proc. U. S. Nat. Mus., XVII, 55, 1894.

Carapace granulate, a tubercle or spine on the gastric, cardiac, and each branchial region and on supraorbital margin. Postorbital projection dentiform, tapering to a slender point. Frontal teeth short, triangular; basal antennal joint terminating in a slender spine directed obliquely forward and equally advanced with the front. Interantennular spine inclined downward, equaling or surpassing the front. A few small spines on sides of branchial and on hepatic and pterygostomian regions. Sternum regularly granulated, except on concave portion between the chelipeds. Chelipeds nearly twice as long as carapace, granulate or spinous; manus swollen; fingers more than half the length of palm, gaping, though narrowly, for two-thirds their length. Ambulatory legs granulate, with tufts of curled setæ and often small spines.

Length of male, 14.4 mm.; width, 12 mm.

From off Marthas Vineyard to the Gulf of Mexico and Caribbean Sea, in 15 to 387 fathoms. Mayaguez Harbor, Porto Rico, 220 to 225 fathoms, station 6070, 1 male, of the form described by me in 1894 as *E. rastellifera spinosa*, which may, however, represent the typical species.

Euprognatha gracilipes A. Milne Edwards.

Euprognatha gracilipes A. Milne Edwards, Crust. Rég. Mex., 184, 1878; pl. XXXV, f. 3, 1879.

Branchial region less swollen and hepatic region more prominent than in *E. rastellifera*. Carapace densely granulous, the granules of varying size and intermixed with tubercles, of which there are five in a transverse row on gastric region. Gastric, cardiac, and branchial regions tipped with a cylindrical spine; a smaller abdominal spine. Hepatic region with a stout spine. Margins of branchial region and pterygostomian ridge armed with smaller spines and tubercles. Front having a deep median groove and terminating in two small triangulate teeth; spines of antennal joint slender, equaling or not quite reaching front; interantennal spine very short. Supraorbital arches very thick and well marked, tipped with a spine directed diagonally forward and outward. Postorbital spines also much more oblique than in *E. rastellifera*. A wide prominent lobe diagonally across sides of epistome. Sternum covered with large tubercles. Sternum extended over bases of legs, forming crenate border around posterior portion of carapace. Chelipeds about 1.5 times the length of carapace, slender, granulate. Margins of merus with short triangular spines. Fingers very slender and gaping. Ambulatory legs also with sharp granules, and tufts of curled hair above.

Length of male, 8 mm.; width, 6.2 mm.

Gulf of Mexico, Florida Straits, and Caribbean Sea; depth 69 to 201 fathoms. Mayaguez Harbor, Porto Rico, 75 to 120 fathoms, stations 6063 and 6067.

Genus **ANASIMUS** A. Milne Edwards.

Anasimus A. Milne Edwards, Crust. Rég. Mex., 350, 1880.

Carapace pyriform, very convex, armed with spines; rostrum simple, pointed, directed upward. Eyes large. Postorbital spine prominent. Supraorbital spine present. Basal article of outer antenna long and narrow, terminating in a spine. Exognath of outer maxillipeds broad posteriorly, very narrow anteriorly; merus of endognath narrow at its base, deeply cut at its antero-internal angle for insertion of palpus, and strongly auriculate behind insertion. Chelipeds of moderate length, the palms swollen in male; fingers long, slender, and curved inward. Ambulatory legs very slender, of nearly equal length in typical forms and more than twice the length of carapace; dactyli long and in typical species unarmed.

Anasimus fugax A. Milne Edwards.

Anasimus fugax A. Milne Edwards, Crust. Rég. Mex., 350, pl. XXXI A, f. 1, 1880.

Carapace longer than broad and bearing on median line three erect spines: the first on gastric region; the second, of same size, on anterior cardiac lobe; the third, smaller, surmounts posterior cardiac lobe. (This one is obsolete in our specimen, which is smaller than the type.) The first article of the abdomen carries a fourth spine. Protogastric lobes and branchial regions armed with a spine. Surface of carapace irregularly granulate; rostrum about one-fourth the entire length of carapace, spinulous above. Upper orbital border armed with a spine. Basal article of antenna with a terminal spine; a spine on line of anterior margin of eyes; a few smaller spines and spinules on margins; flagellum long. Interantennulary septum prolonged downward in a strong triangular tooth. The anterior feet of the male are clothed with stiff and distant hairs and bear a number of spines, chiefly on the margins; fingers of chelæ in contact except at very base. Ambulatory legs cylindrical, smooth, and hairy, the first two pairs of same length, the third and fourth a little shorter. Sternal plastron and abdomen granulate. Abdomen of female very wide.

Dimensions of male: Length of carapace, 13 mm.; width, 9 mm.; total width with the feet extended, 75 mm. (A. Milne Edwards.) Length of Porto Rican male, 7.6 mm.; width, 5.1 mm.

Santa Cruz, 115 fathoms; Barbados, 56 and 82 fathoms. Mayaguez Harbor, 97 to 120 fathoms, station 6067, 1 male.

Genus INACHOIDES Milne Edwards & Lucas.

Inachoides Milne Edwards & Lucas, d'Orbigny's Voy. dans l'Amér. Merid., VI, part 1, 4, 1843.

Carapace longer than broad; cardiac, branchial, and gastric regions swollen. No preorbital spine. Postorbital tooth present, though sometimes very small. Rostrum short and simple, with triangular base, terminating in a spine. Basal antennal joint with an antero-external tooth; flagellum exposed from its insertion. Merus of outer maxillipeds cut at the antero-internal angle for insertion of palpus; antero-external angle rounded. Abdomen of male with six segments, of female with five. Chelipeds enlarged; palms swollen. Ambulatory legs slender, of medium length, the first pair the longest; subprehensile, the propodal joints more or less enlarged distally; dactyli curved, folding against the propodi.

Inachoides intermedius Rathbun.

Inachoides intermedius Rathbun, Proc. U. S. Nat. Mus., XVII, 57, 1894.

Carapace smooth above, or nearly so, punctate; regions well marked. Rostrum sulcate, tipped with a short spine. Postorbital tooth minute. A tubercle on margin of hepatic region, on pterygostomian, and on subbranchial. Basal antennal joint with a blunt tooth at antero-external angle. Sternum of male with a large tubercle on either side between bases of chelipeds. Abdomen of female smooth, punctate, with a median carina. Chelipeds of the male twice as long as carapace, of female a little longer than carapace; a few tubercles on manus, which is subcylindrical; fingers in male two-thirds as long as palm, in female equal to palm; gaping; each with a large basal tooth. Ambulatory legs hairy; carpal and propodal joints considerably enlarged distally; dactyli falciform.

Dimensions of male: Length, 7.3 mm.; width, 5.1 mm.

Off Rio de Janeiro, Brazil, dredged (type locality). Porto Rico: Mayaguez; Boqueron Bay.

Genus EPIALTUS Milne Edwards.

Epialtus Milne Edwards, Hist. Nat. Crust., I, 344, 1834.

Carapace broad, pentagonal or hexagonal, almost smooth, with two or more lateral projections, sometimes very largely developed. Rostrum broad, triangular or oblong, bifid or entire. Eyes small. Preorbital tooth either present or absent; postorbital small, minute, or wanting. Abdomen of male with six or seven segments; of female with five or seven segments. Basal joint of antenna triangular; movable part concealed beneath rostrum. Merus of outer maxillipeds broad, subquadrate, notched at antero-internal angle where the palpus is articulated. Chelipeds strong; fingers with tips excavate or spoon-shaped; in the male either gaping or in contact. Ambulatory legs stout, subcylindrical, diminishing successively in length from first to fourth; propodi sometimes with an inferior tooth or bunch of setæ; dactyli with two rows of spinules beneath.

Epialtus bituberculatus Milne Edwards.

Epialtus bituberculatus Milne Edwards, Hist. Nat. Crust., I, 345, pl. XV, f. 11, 1834; A. Milne Edwards, Crust, Rég. Mex., 139, pl. XXVII, figs. 1, 2, and 3, 1878, and synonymy; Rathbun, Proc. U. S. Nat. Mus., XVII, 1894, 67.
Epialtus sulcirostris Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 198, 1860; A. Milne Edwards, Crust. Rég. Mex., 141, pl. XXVII, f. 6, 1878.
?*Epialtus longirostris* Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 199, 1860; A. Milne Edwards, Crust. Rég. Mex., 141, pl. XXVII, f. 5, 1878.
?*Epialtus minimus* Lockington, Proc. Cal. Acad. Sci., VII, July 17, 1876, p. 77 (15), 1877.
Epialtus dilatatus A. Milne Edwards, Crust. Rég. Mex., 140, pl. XXVII, f. 4, 1878.

Carapace subpentagonal, with two tubercles on gastric region and two lateral teeth or lobes very variable in shape and relative size. In the typical form the lobes are separated by a shallow sinus, the carapace is distinctly widest at the posterior lobe, the rostrum is triangular, obtuse and entire. In the varieties the width at the hepatic region may equal that at the branchial region, the anterior lobe is much more prominent and may be either broad and obtuse or narrow and spiniform. Sometimes one lobe or both has a tubercle on its anterior margin. The rostrum varies in length and shape, and may be either triangular or oblong, and entire or emarginate, sometimes constricted near the base. In the typical form the preorbital teeth are obsolete, but are present, though small, in some of the varieties. Postorbital tooth wanting. Abdomen of male with fourth and fifth segments fused.

Chelipeds variable; propodus in typical form wide, of moderate length, widening slightly toward the distal end; dactylus with a tooth near its base; in the varietal forms the hand may be cristate and widening rapidly toward the fingers. The propodi of the ambulatory legs have a tuft of setæ on the under side proceeding from a slight prominence nearer distal than proximal end, but are without the strong tooth near base represented in the description and figure of *E. brasiliensis* given by Dana.

In 1894 (*loc. cit.*) I gave in detail the variations in the specimens in the National Museum, and I incline to think that the species is subject to as much variation as is *Menæthius monoceros* Latreille, six varieties of which are given by Dana under as many specific names.

Dimensions: Puerto Real, male, length, 9.6 mm.; width, 8 mm.; ovigerous female, length, 7.1 mm.; width, 6 mm.

From Indian River, Florida, to Rio de Janeiro; from Southern California to Chile. Porto Rico: Mayaguez, 1 female (near the *longirostris* form); Puerto Real, 1 male, 1 female, 1 juv. (*dilatatus* form); Arroyo, 1 male, 6 juv. (*brasiliensis* form); Ensenada Honda, Culebra, 1 male (near the *longirostris* form); Fajardo, 1 female (*brasiliensis* form).

Genus ACANTHONYX Latreille.

Acanthonyx Latreille, Encyc. Méth., Hist. Nat., Insectes, X, 698, 1825.

Carapace elongate, almost smooth, lateral margins toothed, the anterior tooth much enlarged. Rostrum with two flattened divergent horns. Orbits small, entirely filled by the large eye peduncles. A preorbital tooth. Antennæ visible at the sides of the rostrum. Merus of outer maxillipeds transverse, dilated at the antero-external angle, notched at the antero-internal angle. Legs short, rather stout. Chelipeds in male enlarged. Ambulatory legs decreasing in length successively from first to fourth pair, compressed; propodi dilated, the posterior margin concave and setose near end, at broadest part forming a blunt tooth against which the dactylus fits like a claw; dactyli spinous on their inner margin. Abdomen of male with six or seven segments.

Acanthonyx petiverii Milne Edwards.

Acanthonyx petiverii Milne Edwards, Hist. Nat. Crust., I, 343, 1834; Dana, Crust. U. S. Expl. Exped., I, 128, pl. V, f. 6, 1852.
Acanthonyx emarginatus Milne Edwards & Lucas, d'Orbigny's Voy. l'Amér. Mérid., VI, pt. 1, p. 9, 1843; IX, pl. V, f. 2, 1847.
Acanthonyx debilis Dana, Am. Jour. Sci. (2), XI, 272, 1851; Crust. U. S. Expl. Exped., I, 127, 1852, pl. V, f. 5, 1855.

Carapace oblong, antero-lateral angles subrectangular, obtuse, frontal region triangular. Two small teeth on margin of branchial region. Carapace almost smooth; three obscure setiferous tubercles on gastric region, one on the cardiac, and one on the intestinal region; these tubercles are obsolete in the female, but the setæ remain. Lateral teeth and rostrum setiferous. Rostrum short, deflexed, bifid. Preorbital lobes obtuse, elevated. No postorbital tooth. Basal joint of antennæ unarmed, the second and third joints subcylindrical, attaining end of rostrum; flagellum very slender. Chelipeds with merus subtriangulate; carpus with an external crest and two or three setiferous tubercles; manus enlarged and compressed; fingers finely dentate, gaping to the extremity in male, almost entirely closed in female. Ambulatory legs with tufts of setæ on extremities of joints; meri and carpi with a few setiferous tubercles on anterior or upper margin. Abdomen with fourth and fifth segments coalesced in both sexes.

Length of male, 18 mm.; width, 12.5 mm.

Bahamas; West Indies; Brazil; Cape St. Lucas to Chile. Arroyo, Porto Rico; Aguadilla (Gundlach).

Genus CHORINUS (Leach MS.) Latreille.

Chorinus (Leach MS.) Latreille, Encyc. Méth., Hist. Nat. Insectes, x, 139 and 699, 1825.

Carapace oblong-oval. Rostrum with two slightly divergent horns. Preorbital spine stout, postorbital small, dentiform, remote from the orbit. Two superior orbital spines. Basal antennal segment short and narrow; flagellum short, concealed beneath the rostrum. Outer maxillipeds with the ischium advanced at the antero-internal angle; merus rhomboidal, outer angle much produced, antero-internal margin oblique, ending posteriorly in a slight tooth. Abdomen (of male at least) with seven segments. Chelipeds elongate. Ambulatory legs of first pair long, remaining pairs very short.

Chorinus heros (Herbst).

Cancer heros Herbst, Natur. Krabben u. Krebse, II, 165, pl. XLII, f. 1, 1796.
Chorinus heros (Leach MS.) Latreille, Encyc. Méth., Hist. Nat., Insectes, x, 139, 1825; Milne Edwards in Cuvier's R. Anim., Disciples ed., Crust., 85, pl. XXIX, f. 2.

Carapace pubescent, convex, posterior two-thirds smooth, anterior third deflexed, covered with short, blunt tubercles or spines, from which proceed a tuft of coarse hairs; these tubercles are continued part way on the rostrum. Rostral horns stout, more or less incurved, about one-third the length of remainder of carapace, furnished with long hairs, which are very abundant on inner margin. Preorbital spines about one-third the length of rostral horns, curved and directed forward. Marginal spines two, one gastric and one hepatic, the former the longer, flattened, both curved. Above the orbit are two tubercles or stout spines, the anterior the larger and more or less compound. The branchial region has a few tubercles at anterior angle and on its antero-lateral margin. Subhepatic and pterygostomian regions tuberculate. Basal antennal joint with a stout spine at its extremity and a tubercle on lateral margin, and in the same line there is a tubercle near angle of buccal cavity; first two joints of flagellum flattened, the first joint widening at its distal extremity. Chelipeds naked and smooth, attaining a length of 1.5 times the length of the carapace in the male; merus cylindrical; manus compressed and slightly dilated, the palmar portion about twice the length of fingers. Fingers gaping slightly for their distal third. Ambulatory legs stout, pubescent and hairy, the first pair attaining a length greater than that of carapace; second, third, and fourth pairs much shorter and decreasing regularly in length.

Length of male, according to the figure given by Milne Edwards, 64 mm.; width, 36.2 mm.; length of horns, 14.2 mm.

Florida Keys; West Indies; Rio Vermelho, Bahia, Brazil; Bermudas. Porto Rico: San Antonio Bridge, San Juan; Caballo Blanco Reef, Vieques; off Vieques, 14 to 16 fathoms, stations 6085 and 6092; off Humaçao, 9½ fathoms, station 6099. Specimens mostly very young. Aguadilla (Gundlach).

Genus SCYRAMATHIA A. Milne Edwards.

Amathia Roux, Crust. Médit., pl. III, 1828, with accompanying description. (Name preoccupied.)
Scyramathia A. Milne Edwards, Comptes Rendus de l'Acad. sci. Paris, XCI, 356, 1880.
Anamathia Smith, Proc. U. S. Nat. Mus., VII, 1884, 493 (1885).

Carapace subtriangulate, with posterior margin rounded; armed with spines or spines and tubercles. Preorbital spine usually present; postorbital lobe present. Basal antennal joint slender and either unarmed or with one or more spines. Merus of outer maxillipeds truncated distally, and slightly produced at the antero-external angle. Chelipeds usually slender, often greatly elongated in the male. Ambulatory legs slender and elongated.

Scyramathia hystrix (Stimpson).

Amathia hystrix Stimpson, Bull. Mus. Comp. Zool., II, 124, 1871. A. Milne Edwards, Crust. Rég. Mex., 131, 1878; 200, pl. XXVIII, f. 1, 1879.
Anamathia hystrix Smith, Proc. U. S. Nat. Mus., VII, 1884, 493 (1885).

Carapace convex, covered with a tuberculiform pubescence and armed with sixteen long, slender, and sharp spines—two rostral; four median, of which two are gastric, one cardiac, and one intestinal; one gastric spine on either side of the median line; one hepatic on the margin; and three branchial, of which one is on the margin. Preorbital spine slender and much shorter than other dorsal spines; postorbital lobe slightly developed. Basal antennal joint with a spine at antero-external angle, a longer spine at the antero-external angle of buccal cavity. Chelipeds slender and weak, shorter and very little stouter than ambulatory legs; merus cylindrical, with a terminal spine; carpus with an outer spine; manus slightly compressed and widening distally. Fingers toothed throughout their length, very little gaping. First ambulatory leg much the longest; all very slender; the meral joints terminate in a spine.

Dimensions of male: Length, including rostrum, 31.2 mm.; excluding rostrum, 18 mm.; breadth including lateral spines, 24.1 mm.; excluding spines, 12.1 mm. (Stimpson.)

Florida Straits; West Indies. Depth, 82 to 387 fathoms. Mayaguez Harbor, Porto Rico, 220 to 225 fathoms, station 6070; 1 female.

Genus PELIA Bell.

Pelia Bell, Proc. Zool. Soc. London, III, 170, 1835.

Carapace pyriform, swollen, without tubercles and covered with a thin coating of soft hair. Rostrum well developed, composed of two rostral horns, united at base, divergent at their extremity. Upper orbital border smooth, without a spine. Basal article of antennæ long, slender, and forming only an incomplete floor of orbit; it is advanced beyond orbital border and appears on borders of rostrum; flagellum well developed. The eye folds back into a fossette hollowed from the base of a tubercle limiting anterior boundary of hepatic region. Merus of outer maxillipeds notched at front inner angle for insertion of palpus. Chelipeds rather long, but feeble; fingers sharp-pointed, finely denticulate and in contact in their terminal half; movable finger with a large tooth near its base, which fits into an excavation in the pollex; the arm has a superior crest. First pair of ambulatory feet much longer than the others; last pair very small; meral joints much compressed, and having a prominent crest above; dactyli unarmed. Abdomen of male narrow, with seven segments.

Pelia mutica (Gibbes).

Pisa mutica Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 171, 1850.
Pelia mutica Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 177, 1860; A. Milne Edwards, Crust. Reg. Mex., 73, pl. XVI, f. 2, 1875.

Regions elevated, especially gastric and cardiac, which is surmounted by a rounded prominence. Lateral border entire. Rostrum almost two-fifths as long as rest of carapace; a furrow on its basal portion; horns more or less divergent. Basal antennal joint with or without a small spine at its outer extremity. Chelipeds in male about as long as body.

Dimensions of male: Length, 9.5 mm.; width, 5.8 mm.

Vineyard Sound to the west coast of Florida; Florida Straits. Porto Rico: Mayaguez; Boqueron Bay; off Boca Prieta, 8½ fathoms, station 6075; off St. Thomas, 20 to 23 fathoms, station 6079. Porto Rico is beyond the recorded limit of this species, which is, however, doubtfully distinct from *P. rotunda* A. Milne Edwards, of the South American coast, from Brazil to Patagonia.

Genus HEMUS A. Milne Edwards.

Hemus A. Milne Edwards, Crust. Rég. Mex., 88, 1875.

Carapace thick and swollen; longer than wide. Rostrum small; no preorbital spines; orbit incomplete below. Second and third articles of the external antennæ remarkably wide and flat; the multiarticulate flagellum inserted at the external angle of the third article. Merus of outer maxillipeds long and little dilated outwards; exognath very wide in its basal and middle portion, narrowing toward its extremity. Chelipeds small; fingers slightly gaping, strongly bent inward toward their extremity, but scarcely spoon-shaped. Ambulatory legs short, but very strong; merus ornamented with cristiform prolongations; dactyli strong, much curved, without denticulations below.

Hemus cristulipes A. Milne Edwards.

Hemus cristulipes A. Milne Edwards, Crust. Rég. Mex., 88, pl. XVI, f. 1, 1875.

Body and feet almost completely smooth. The rostrum is wide, short, bicarinated above, bent downward, and bifurcated at its extremity. Upper orbital border unarmed, but having a narrow fissure; the postorbital cavity into which the eye can be retracted is incomplete. Basal article of outer antennæ wide, short, and not spinulous; a notch separates it from lower border of carapace. The carapace sparsely granulous; very swollen, especially in cardiac region, which is markedly prominent. Postorbital portion wide; gastric region high; branchial regions elliptical, bearing on each side two subacute prominences directed outward; the first stronger than second. Chelipeds of male very small and smooth. First pair of ambulatory legs longer and stronger than the others; fifth very small. Merus of all the legs very wide, having above a crest and below a lamellar prolongation with a crenulate and arcuate border; other joints of feet small. Abdomen of both sexes with seven free segments, the last elongate in the male.

Dimensions of female: Length, 7 mm.; width, 5.7 mm.

Gulf of Mexico; Central America. Depth, 8½ to 27 fathoms. Porto Rico: Off Boca Prieta, 8½ fathoms, station 6075; off Vieques, 15 fathoms, station 6091 off Culebra, 15 fathoms, station 6093.

Genus THOE Bell

Thoe Bell, Proc. Zool. Soc. London, III, 170, 1835.
Platypes Lockington, Proc. Cal. Acad. Sci., VII, Mar. 20, 1876, p. 41 (1), 1877.

Carapace of moderate width, thick, lobulate; fronto-orbital region wide; rostrum small; no preorbital spine; orbital border unarmed. Basal article of antenna large; second article rather flat and attached to first joint near rostrum, but at a great distance from orbit. Exognath of outer maxillipeds very wide in middle. Sternal plastron almost circular. Chelipeds long and usually strong; hand compressed; fingers spoon-shaped, gaping in the adult. Ambulatory feet wide, decreasing rapidly in length from the first to the fourth; meral joints with longitudinal crests; last two joints short and nodose.

Key to the Porto Rican species of the genus Thoe.

A. Carapace and basal antennal joint without spines .... *puella*
A′. Carapace with postero-lateral spines; basal antennal joint with two distal spines .... *aspera*

Thoe puella Stimpson.

Thoe puella Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 178, 1860; A. Milne Edwards, Crust. Rég. Mex., 122, pl. XIX, f. 3, 1873.

Antero-lateral margins straight or nearly so; lobulations of dorsal surface well marked, covered with bunches of granules crowded together. Rostral horns separated by a deep, narrow fissure. Antennæ fringed with long hair; basal joint as wide as long, with antero-external angle a blunt tooth. Arm and wrist of chelipeds covered with fine granulations, the arm with a line of tubercles on upper margin; hand smooth and shining except near articulation, where it is granulate, superior margin sharp for its proximal half; fingers finely serrulate within; a tooth near base of dactyl in male; fingers rather widely gaping in adult male; narrowly gaping in adult female. The posterior laminate crests on meral joints of ambulatory legs longer than anterior and about twice as wide; their upper surfaces concave, margins undulate and finely crenulate; carpal joints have a bilobed anterior crest and a tooth on posterior margin; propodal joints with a narrow crest on each side and a blunt spine above.

Color, reddish, or a brilliant red, with yellow spots (A. Milne Edwards).

Dimensions of male: Length, 10.4 mm.; width, 9 mm.

Florida Keys; West Indies. Reefs at Ponce, Porto Rico.

Thoe aspera, sp. nov.

Carapace more elongate than in *T. puella*, the gastro-cardiac suture is farther back, or halfway between posterior margin of carapace and posterior margin of orbit. Lobules separated by shallower depressions than in *T. puella*; protogastric and mesogastric lobules surmounted by high, acute tubercle; cardiac lobule with a similar but lower tubercle. Postero-lateral angle with a short spine; above and anterior to the spine, a sharp tubercle; another on each side of the middle near posterior margin; and in front of these last still another on branchial region. Rostral horns curving slightly inward and separated by a large V-shaped sinus. Basal antennal joint narrower than in other species of genus, considerably longer than broad and armed distally with two spines, outer one above inner, both visible in a dorsal view; outer margin concave, a longitudinal crest at outer third; both crest and margin finely crenulate. Cheliped of male (perhaps not fully developed) rather feeble. The arm, wrist, and proximal fourth of palm are finely granulate; the arm has sharp granulated margins. The greater part of palm is smooth and shining; three times as long as wide; the fingers gape slightly for two-thirds their length and are finely denticulate. Crests of meral joints of ambulatory legs of about equal width; anterior crest has one or two teeth, the posterior one has a rectangular distal prolongation. The carpal joints have a triangular inner tooth and a narrow outer crest. Surface sparingly pubescent; some longer hairs form lines on rostrum and in the depressions of carapace.

Dimensions of male: Length, 10 mm.; width, 8.2 mm.

A male and a young female were taken at Ensenada Honda, Culebra (Cat. No. 23773). This species is readily distinguished by its spines and sharp tubercles and elongate basal antennal joint.

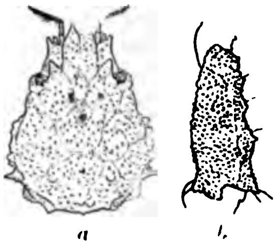

FIG. 10.—*Thoe aspera*, male. (*a*) Carapace, × 2.5. (*b*) Merus of an ambulatory leg of right side, × 6.

Genus LISSA Leach.

Lissa Leach, Zool. Misc., II, 69, 1815.
Lissula Rafinesque, Amer. Monthly Mag., III, 272, Aug., 1818.

Carapace very convex; surface very uneven; mesogastric region especially elevated, sides of gastric and branchial regions steep. Preocular spine or tooth present. Horns of rostrum flattened, contiguous, truncate, outer extremities of anterior margin forming a small lateral lobe. Orbit with a superior and an inferior closed fissure; eyes when retracted fitting into cup-shaped inconspicuous postorbital lobe. Basal joint of antennæ much enlarged, entire, distal margin of outer portion united with front margin of carapace. Ischium of outer maxillipeds inwardly strongly advanced; merus subtriangular, dilated outwardly; a very shallow sinus at articulation of palpus. Chelipeds with palm compressed, sometimes carinated; fingers gaping at base in the male. Ambulatory legs of moderate length, decreasing rapidly in size from the first to last, either cristate or nodose; dactyli unarmed.

Lissa bicarinata Aurivillius.

Lissa bicarinata Aurivillius, Kongl. Sv. Vet. Akad. Hand., Bd. 23, No. 4, 54, 1889; Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 255, 1898.

Carapace with two rounded median prominences, one gastric and one cardiac, the former much larger and higher. From the gastric prominence two ridges run divergently backward to postero-lateral angles of carapace. Both the median prominences and ridges are indistinctly tuberculate. Posterior outline arcuate and separated from blunt postero-lateral angles by a broad rounded sinus. Sides of branchial and gastric regions steep. Outer margin of branchial region with a broad and shallow tooth at its middle. Outer margins of hepatic regions almost parallel. Rostrum wide, deflexed, subtruncate, widening at extremity, which is four-lobed; median lobes rounded and separated by a narrow U-shaped fissure; outer lobes smaller, blunt, slightly less advanced than median. Upper surface of rostrum slightly concave in a longitudinal direction. There is a short, acuminate preorbital spine directed obliquely upward. Legs furnished with triangular laminate crests.

Dimensions of ovigerous female: Length, 9.5 mm.; width, 9.2 mm.

Bahama Banks; St. Bartholomew (Aurivillius). Mayaguez Harbor, 4 to 6 fathoms, station 6065; off Vieques, 12½ fathoms, station 6095.

Genus TELEOPHRYS Stimpson.

Teleophrys Stimpson, Amer. Jour. Sci. (2), XXIX, 133, 1860.

Allied to *Mithrax*, but distinguished by the character of the orbits, which have the superior and exterior margins entire, and not armed with tubercles or spines. There is sometimes an indication of a superior fissure entirely closed up, but no trace of an exterior one. Basal joint of external antennæ rather narrow for the group to which this genus belongs, tapering anteriorly, armed with a slight tooth at antero-exterior angle and another still smaller at middle of outer margin. Merus of outer maxillipeds broader than ischium, three-fourths as long, and notched at internal angle for reception of palpus. Legs cristate.

Teleophrys ornatus, sp. nov.

Carapace longer than broad; two median tubercles, one gastric and one cardiac; a stout suberect spine on branchial near postero-lateral angle; three very small spines on lateral margin of branchial region; a tubercle on margin of hepatic region; two stout tubercles above posterior margin; lateral margin granulated; a few other tubercles and tufts of hair scattered on carapace. Rostral teeth small, blunt; preorbital lobes smooth, rounded, prominent; two faint sutures evident in upper margin of orbit. Basal joint of antenna with an antero-external tooth and a tubercle on outer margin. Cheliped of female very feeble; upper margin cut into laminate lobes; wrist also ornamented with about five similar lobes; hand smooth, tapering distally; fingers gaping a very little at base. Ambulatory legs with a margin before and behind of irregular laminate lobes, on meral, carpal, and propodal segments; dactyli about as long as propodi, strongly curved, acuminate, denticulate.

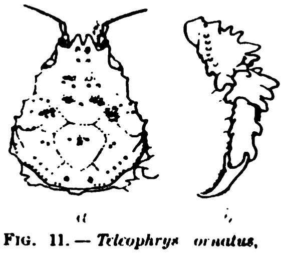

FIG. 11. — *Teleophrys ornatus*, female. (*a*) Carapace, × 4. (*b*) Ambulatory leg, × 8.

This species differs from *T. cristulipes* chiefly in its longer carapace and in the more elaborate crests on the legs, which are present on the posterior as well as the anterior margin.

Length of female, bearing eggs, 5.6 mm.; width, 4.7 mm.

One female from Mayaguez Harbor in 4 to 6 fathoms, station 6065 (Cat. No. 23774).

Genus **MITHRAX** Latreille.

Mithrax Latreille, Règne Anim. de Cuvier, III, 23, 1817.
Trachonites Latreille in Desmarest, Dict. Sci. Nat., XXVIII, 263, 1823.
Mithraculus White, List Crust. Brit. Mus., 7, 1847.

Carapace subtriangular, either broader than long or slightly longer than broad. The front has two small rostral horns, often pointed, beside which are other spines or prominences, either preorbital or antennal. Orbital borders more or less spinous or tuberculous. Basal article of antenna wide, armed in front with two or three strong spines; second article inserted outside the orbit, at base of rostrum. Merus of outer maxillipeds wide and dilated outwardly; exognath wide. Sternal plastron almost circular. Chelipeds long and strong, especially in male; fingers deeply hollowed out at tip, gaping considerably when shut. Ambulatory legs robust, armed with spines and terminated by hooked fingers, and often armed with spines on lower surface. Abdomen of male formed of seven free segments.

Key to the Porto Rican species of the genus Mithrax.

A. Carapace without oblique parallel branchial sulci.
  B. Manus with spines or spinules.
    C. Carapace nearly naked .... *spinosissimus*
    C′. Carapace covered with setæ.
      D. Granules of carapace concealed by the dense setæ, which are all alike .... *pilosus*
      D′. Granules of carapace not concealed by the setæ, which are of two kinds and varying in length .... *plumosus*
  B′. Manus without spines.
    C. Rostral horns blunt or tuberculiform.
      D. Antero-lateral prominences four.
        E. Carapace and wrist smooth or nearly so.
          F. Basal antennal joint with two teeth or spines .... *hispidus*
          F′. Basal antennal joint with three teeth or spines .... *lævimanus*
        E′. Carapace and wrist distinctly tuberculate.
          F. Rostral horns about as long as broad .... *depressus*
          F′. Rostral horns shorter, broader than long .... *pleuracanthus*
      D′. Antero-lateral prominences three; postero-lateral one .... *ruber*
    C′. Rostral horns sharp.
      D. Rostral horns short.
        E. Four lateral spines .... *hemphilli*
        E′. Two lateral spines .... *holderi*
      D′. Rostral horns long and slender .... *acuticornis*
A′. Carapace with oblique parallel branchial sulci.
  B. Antero-lateral margin spined.
    C. Carapace longer than broad .... *cinctimanus*
    C′. Carapace broader than long .... *forceps*
  B′. Antero-lateral margin lobed.
    C. Carapace slightly broader than long. Postero-lateral angle rounded .... *sculptus*
    C′. Carapace much broader than long. Postero-lateral angle angular .... *coryphe*

Mithrax acuticornis Stimpson.

Mithrax acuticornis Stimpson, Bull. Mus. Comp. Zool., II, 116, 1870; A. Milne Edwards, Crust. Rég. Mex., 98, 1875.
Mithrax (Nemausa) acuticornis Rathbun, Proc. U. S. Nat. Mus., XV, 260, pl. XXXVII, f. 1, 1892.
Nemausa rostrata A. Milne Edwards, Crust. Rég. Mex., 81, pl. XVII, f. 4, 1875.

Carapace longer than broad, armed especially on posterior and lateral portions with sharp spines and spinules. Antero-lateral margin with four slender, sharp spines, the first three of which have a smaller anterior spine; a short postero-lateral spine. Rostral horns in large specimens two-fifths as long as remainder of carapace, in small specimens relatively shorter; slender, acuminate, diverging. Preorbital spine acute, obliquely ascending; postorbital spine equally long; two shorter spines above and two below the orbit. Antennal joint with a long antero-external spine, a third or more as long as the rostrum; an outer spine much shorter; a third but extremely short spine at the base of the second joint. Arm and wrist armed with very sharp spines; hand smooth. Meral and carpal joints of ambulatory legs spinous, the spines forming two marginal rows on upper surface.

This species has a strong resemblance to young *M. spinosissimus*.

Dimensions of male: Entire length of carapace, 21.4 mm.; entire width, 14.2 mm.

Gulf of Mexico and Caribbean Sea, 12 to 121 fathoms; Bermudas. Mayaguez Harbor, 25 to 30 fathoms, station 6062, 1 young female.

Mithrax spinosissimus (Lamarck).

Maia spinosissima Lamarck, Hist. Nat. Anim. sans Vert., v, 241, 1818.
Mithrax spinosissimus Milne Edwards, Mag. Zool., II, pls. 2 and 3, 1832.

Carapace covered with spines more or less elongate, which tend to disappear in very large individuals; surface between spines smooth. Rostrum formed of two short and slightly divergent horns. Preorbital spines sharp and directed a little upward. Two spines on basal article of external antennæ. Orbital border cut into five or six additional spines. Antero-lateral margin armed with five or six large spines, of which the first two are bifurcate. Chelipeds very large. Arm and wrist spiny. The upper border of the hand has a double row of spines, which become blunt or tuberculiform with age; the inner face has two or three tubercles near the wrist. Ambulatory legs very spinous. Merus of external maxillipeds deeply cut at its inner angle.

Color, vinous red, with yellowish tints (A. Milne Edwards).

Dimensions of male: Entire length, 131.4 mm.; entire width, 136 mm. This is the largest species of the genus. Young specimens are more elongate (longer than broad) and have longer horns.

Bahama Banks; Florida Keys; West Indies. Bayamon (Gundlach); San Juan (G. M. Gray).

Mithrax pilosus Rathbun.

Cancer aculeatus Herbst, Natur. Krabben u. Krebse, I, 248, pl. XIX, f. 104, 1790. (Not *C. aculeatus* O. Fabricius, 1780.)
Mithrax aculeatus Milne Edwards, Mag. Zool., II, 1832.
Mithrax pilosus Rathbun, Proc. U. S. Nat. Mus., XV, 262, pl. XXXIX, 1892.

Carapace wider than long in specimens of large size, but in small specimens the length and width are more nearly equal. It is covered, as well as the legs, with plumose setæ, which are crowded and conceal the surface; when removed, they disclose flattened granules. Carapace also furnished with spinose tubercles as follows: Three, small, arranged longitudinally each side of median line just behind rostrum; four transversely on gastric region in two distant pairs; one further back on median line of gastric; three forming a triangle on cardiac; nine or ten scattered on each branchial region; four in an arcuate row above posterior margin. Lateral spines five (the fifth postero-lateral), stout, triangular, tips hooked forward, the first ones often double or triple, especially in specimens of large size. Rostral horns strongly incurved at tips. Preocular spine prominent, upturned. Three other orbital teeth—one above, one below, one external. Basal antennal joint with a long antero-external spine, hooked inward; on outer margin a triangular tooth; another at insertion of second joint. Chelipeds large; arm and wrist very spiny; hand with a few tubercles or spines on superior margin near wrist. Ambulatory legs stout; meral and carpal joints spiny.

Dimensions of male: Entire length, 113.2 mm.; entire width, 124 mm.

Bahamas; Florida Keys to Venezuela; West Indies. Porto Rico: Reefs at Guanica; reefs at Ponce; Culebra; Aguadilla (Gundlach).

Mithrax plumosus, sp. nov.

Mithrax aculeatus Rathbun, Proc. U. S. Nat. Mus., xv, 264, 1892. (Not *M. aculeatus* (Herbst) Milne Edwards.)
Mithrax verrucosus variety, Rathbun, Ann. Inst. Jamaica, I, 9, 1897.

Carapace wide, little swollen, and covered with very flat and crowded granules, with some raised tubercles toward lateral and frontal margins; surface covered (but not sufficiently to obscure the granulation) with plumose bristles and tufts of longer, stiffer bristles arising from each tubercle. Rostral horns short, truncate, interspace wider than horn. Preorbital tooth blunt, directed a little outward. Basal article of antenna with three blunt spines; the orbital border has, besides, four blunt spines. Antero-lateral margin armed with four slender subacute spines, of which the first three are double; the anterior of each double spine is the smaller; a short postero-lateral spine. Inner margin of arm and wrist armed with sharp spines; upper surface spinous; arm with five or six sharp spines on outer margin; hand with a few spinules on upper surface near wrist. Palm and fingers otherwise smooth, naked, and shining. The rest of the chelipeds and also the ambulatory legs hairy like carapace. Meral and carpal joints of ambulatory legs spinous. Young specimens have the rostral horns relatively longer and sharper; the hand is rougher than in the adult and hairy at the proximal end.

This species I at first mistook for *M. aculeatus* (Herbst), and later thought it might be a variety of *M. verrucosus*, to which it is most closely related. *M. aculeatus* (Herbst), now *M. pilosus*, is furnished with much stronger lateral spines and the setæ covering the surface are denser and all of the same character. *M. verrucosus*, on the other hand, has the carapace bare or nearly so, and the hand and upper surface of the wrist are unarmed; the young have the rostral horns relatively shorter than the adult, while the reverse is true in *M. plumosus*. This species is of more frequent occurrence than either of those with which it has been confounded.

An ovigerous female from Puerto Real measures 30 mm. long, including horns, and 35.8 mm. wide, including spines. This specimen may be taken as the type (Cat. No. 23775). Also found in Porto Rico at Boqueron; reefs at Ponce; Arroyo; Caballo Blanco Reef, Vieques; Ensenada Honda, Culebra; Fajardo. Bahamas; Florida Keys; West Indies; Fernando Noronha.

Mithrax hispidus (Herbst).

Cancer hispidus Herbst, Natur. Krabben u. Krebse, I, 247, pl. XVIII, f. 100, 1790.
Mithrax hispidus Milne Edwards, Mag. Zool., II, 1832; A. Milne Edwards, Crust. Rég. Mex., 93, pl. XXI, f. 1, 1875.

Carapace swollen, considerably wider than long, smooth, except for some low, rounded prominences chiefly toward the outer margin of the branchial region. Gastric tubercles very faint. Front wide; horns short, obtuse, interspace U-shaped, as wide as either horn. Preorbital angles blunt, slightly produced. Basal joint of antenna with two teeth, inner one nearly reaching line of rostrum, the other smaller, on orbital border; besides, the orbit has four tubercles on margin, two superior, much smaller than external or inferior tubercle. Lateral margin armed with five spiniform teeth; the first obtuse, often bifid at extremity; the second longer, sharp and double, curving forward; third and fourth more slender and about the same length; fifth postero-lateral, much smaller, and situated higher up on carapace. Subhepatic region with two tubercles; a number of tubercles, some of them pointed, are on the subbranchial and pterygostomian regions. Arm with four or five spines on upper margin; two on inner margin; and a few tubercles on the upper surface. Wrist smooth; inner margin evenly rounded. Hand smooth; fingers narrowly gaping; a broad, low tooth near the base of the dactylus. In young specimens the tubercles of the carapace are more protuberant.

Dimensions of male: Length, 86.5 mm.; width, including spines, 114 mm.

Bahamas; Florida Keys; West Indies; Venezuela; Bahia and Abrolhos Islands, Brazil; Bermudas. Guanica, Porto Rico; San Juan (Gundlach).

Mithrax lævimanus Desbonne & Schramm.

Mithrax lævimanus Desbonne & Schramm, Crust. Guadeloupe, 7, pl. I, figs. 1 and 2, 1867; A. Milne Edwards, Crust. Rég. Mex., 91, pl. XXI, f. 2, 1875.

Resembles *M. hispidus;* the carapace smooth, and having only a few rounded prominences, but narrower; the front also is narrower and much more produced. Preorbital projections rounded. The basal article of antenna bears three blunt spines, one below insertion of next article, one stronger at antero-external angle, the third equally large at antero-internal angle. Orbital border with only three tubercles. Lateral margins armed with five almost cylindrical spines, which are simple and directed almost forward; the first and fifth are smallest; the fifth is post-lateral. Three strong projections on branchial regions. Wrist with a large tubercle on inner margin; otherwise the feet resemble those of *M. hispidus*. Sternal plastron deeply hollowed anteriorly for seventh abdominal segment; sixth abdominal segment very wide in its anterior part. Merus of outer maxillipeds longer and much less deeply cut at its inner angle than in *M. hispidus*.

Carapace a violet brown; claws and feet spotted with a wine-colored violet (A. Milne Edwards).

Dimensions of male: Length, 65 mm.; extreme width, 78 mm. (A. Milne Edwards).

Guadeloupe (type locality). This species was not found by the *Fish Hawk* party, nor is it recorded by Gundlach, but I chanced to note in the Museum at Berlin, in 1896, a small male, labeled "Porto Rico. Gundlach." The spots on the chelipeds were a striking feature of the preserved specimen.

Mithrax depressus A. Milne Edwards.

Mithrax depressus A. Milne Edwards, Crust. Rég. Mex., 96, pl. xx, f. 4, 1875

Closely allied to *M. hispidus*. Carapace narrower across branchial regions; antero-lateral margins more arcuate than in *M. hispidus*, that is, after curving well outward anteriorly, they turn inward near lateral angle more than in that species. Tubercles of carapace prominent; on gastric region there are five tubercles in a transverse row, and in front of these two pairs of tubercles, the anterior pair at base of the rostral horns; on mesogastric region are two tubercles on each side in a transverse line; on branchial region the four principal tubercles form a rhomboid; in front of anterior of these tubercles are two or three smaller ones; near posterior margin of branchial region are about eight unequal tubercles forming two irregular rows. Space between the rostral horns U-shaped and narrower than either horn. Anterior of lateral branchial spines more swollen than in *M. hispidus* and blunter; spine on its front margin is reduced, tubercles above are enlarged; tubercles present on second and third branchial spines also. Arm with two blunt spines on anterior margin, the distal one large, proximal one small. Otherwise as in *M. hispidus*.

Dimensions of male: Length, 43.5 mm.; width, 51 mm.

Bahamas; Florida Keys, to 19 fathoms; West Indies; off Cape St. Roque, Brazil, 20 fathoms; off the Abrolhos, Brazil, 30 fathoms (*Hassler*); Bermudas. Porto Rico: Hucares, 2 males; young specimens were taken at the following stations: Off Puerto Real, 8½ fathoms, station 6074; off St. Thomas, 20 to 23 fathoms, stations 6079, 6080; off Vieques, 6 to 14 fathoms, stations 6085, 6096; off Culebra, 15 to 16 fathoms, stations 6090, 6093; off Humaçao, 9½ to 12½ fathoms, stations 6098, 6099.

Mithrax pleuracanthus Stimpson.

Mithrax pleuracanthus Stimpson, Bull. M. C. Z., II, 116, 1871; A. Milne Edwards, Crust. Rég. Mex., 95, pl. xx, f. 3, 1875.
Mithrax hispidus Rathbun, Proc. U. S. Nat. Mus., xv, 265, 1892 (part).

In 1892 (loc. cit.) I believed *M. pleuracanthus* to be synonymous with *M. hispidus;* since then I have reconsidered the question and have examined more material, including type specimens of *M. depressus*, and have come to the conclusion that these three species can be maintained. The differences are very subtle, and not evident without careful study. The form of the carapace in *M. pleuracanthus* resembles that of *M. hispidus;* the third or posterior branchial spine is longer, and the second spine shorter, than the first; there are several tubercles about the base of each lateral spine. The tubercles of the carapace are well marked as in *M. depressus*. The two tubercles of each pair on the mesogastric region are confluent. The rostral horns of *M. pleuracanthus* are shorter and wider than in *M. hispidus* or *M. depressus*, and the interspace is narrower and inclines toward the triangular. The arm has on its anterior margin either a single spine, or a spine with a tubercle on its proximal slope. I may add that in young specimens these differences are less evident, making it almost impossible to separate the species with certainty.

Dimensions of male: Length, 33.6 mm.; width, 40.7 mm.

Florida Keys; West Indies; Gulf of Mexico. Depth, 3 to 125 fathoms. Porto Rico: Off Vieques, 14 fathoms, station 6085, 1 male, 3 young; off Humaçao, 12½ fathoms, station 6098, 1 young; San Juan (G. M. Gray).

Mithrax ruber (Stimpson).

Mithraculus ruber Stimpson, Bull. Mus. Comp. Zool., II, 118, 1871.
Mithraculus nudus A. Milne Edwards, Crust. Rég. Mex., 110, pl. XXIII, f. 2, 1875.
Mithrax ruber Miers, *Challenger* Rept., Zool., XVII, 87, 1886.
Mithrax nudus Miers, *loc. cit.*

Carapace much wider than long; surface naked, polished, and uneven. A few smooth, rounded prominences are on branchial region; some small depressed tubercles are arranged in transverse rows on gastric region, and larger ones occur on cardiac and branchial regions. The lateral protuberances are four, the first two blunt, the last two sharp, spiniform, the third largest and most produced, the fourth post-lateral; a tubercle on anterior slope of the second tooth, a spine in the interval between second and third. Frontal horns very short, thickened, upturned, blunt; interspace narrow. Behind the horns two small prominences. Margin of orbit thickened, especially the preorbital lobe; a small tooth on upper margin; otherwise entire. Basal antennal joint rather narrow, with two lobes, one large and thick at antero-external angle and further advanced than preorbital lobe, the other small, on outer margin. Chelipeds strong; arm with a single lobe at proximal end of anterior margin, four spines on posterior margin, and two spines on upper surface; wrist almost smooth; hand smooth; fingers denticulate except at base; the movable finger in the full-grown male bears a strong tooth near its proximal third; fingers gaping. Ambulatory legs spinous and hairy.

Entire length of ovigerous female from Arroyo, 13 mm.; entire width, 15.8 mm.

Mayaguez, on coral reef, one male; Playa de Ponce Reef, two young; Arroyo, on Lighthouse Reef, 1 female, 1 young. Cuba (Stimpson); Guadeloupe (Geneva Museum).

Mithrax hemphilli Rathbun.

Mithrax hemphilli Rathbun, Proc. U. S. Nat. Mus., XV, 263, pl. XXXVII, f. 2, 1892.

Carapace oblong-triangular, covered with strong tubercles and granules. The largest tubercles are arranged as follows: One on either side of the middle, in a line with posterior margin of orbit; a transverse row of four on protogastric lobes; three median mesogastric; one genital; a line of three on the cardiac forming a transverse curve concave forward; behind these, one on median line; from seven to eight on branchial region, those most posterior being spinous; four spinous tubercles on intestinal region forming a transverse curve concave to posterior margin; the two tubercles at extremities of this curve are continuous with a line of granules which borders the posterior margin. The two central protuberances of the marginal line are small tubercles. Numerous smaller tubercles and granules scattered or clustered about the larger tubercles; a row of granules just within and parallel to posterior margin of mesogastric region. Rostrum rather long for the genus, horns acute, curving inward at tip; outer margin finely denticulate. Preocular tooth long, acute, elevated, the tips being in a horizontal line with posterior margin of rostral sinus. The two sinuses of upper orbital margin are triangular and inclose a subtriangular, truncate tooth. Four antero-lateral spines, stout, conical, and embossed with granules and tubercles; also a few intermediate and much smaller spines; a short post-lateral spine just above margin. Basal joint of antenna armed with four spines and teeth; a long, slender spine at anterior outer angle, overreaching preorbital spine; a shorter spine or tooth on outer margin, forming one of two on the margin of orbital floor; at the base of the first movable joint a spiniform tooth just visible in a dorsal view; obliquely behind this is another tooth, succeeded by four others which cross the subhepatic region. Chelipeds rather feeble; arm with an upper and outer row of spines and four or five rows of tubercles; wrist tuberculous; hand smooth, with parallel margins; fingers showing only a small hiatus at base when closed. Ambulatory legs spinous; the spines on the meral joints strong.

Dimensions of male: Entire length, 19.8 mm.; entire width, 19.9 mm.

Indian Key, Florida; Rio Formoso, Pernambuco; Abrolhos Islands, Brazil. Ensenada Honda, Culebra, 2 males, 1 female.

Mithrax holderi Stimpson.

Mithrax holderi Stimpson, Bull. Mus. Comp. Zool., II, 117, 1871; Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 259, pl. III, f. 2, 1898.

Carapace oblong, covered with unequal, prominent tubercles, and with large, crowded punctæ. Frontal horns depressed, nearly horizontal, narrow, short,. acute. Basal antennal joint with three spines, antero-external long, nearly as advanced as the rostrum and directed obliquely upward and outward; outer spine small; a third spine or sharp tooth is placed at insertion of second joint. Orbital spines and teeth five, exclusive of antennal; preorbital acute, elevated, curved inward. Antero-lateral margin with two prominent spines—one hepatic, the other at branchial angle; between them are two clusters of tubercles; in front of and behind branchial spine is a small spine or spinule. Inferior regions of carapace covered with tubercles, which become spinulous on subhepatic region. Arms of chelipeds with blunt spines above; hands unarmed. Ambulatory legs flattened above and hairy; meral and carpal joints armed with two rows of spines.

Dimensions of female: Entire length of carapace, 21.5 mm.; entire width, 21.2 mm.

Tortugas, 7 fathoms; St. Croix; St. John. Off Vieques, 21 fathoms, station 6089, 1 young specimen.

Mithrax cinctimanus (Stimpson).

Mithraculus cinctimanus Stimpson, Amer. Jour. Sci., XXIX, 132, 1860; Ann. Lyc. Nat. Hist. N. Y., VII, 186, 1860; A. Milne Edwards, Crust. Rég. Mex., 112, pl. XXIII, f. 3, 1875.
Mithrax cinctimanus Miers, *Challenger* Rept., Zool., XVII, 87, 1886.

Carapace longer than broad and covered, especially on posterior two-thirds, with small, rounded lobules. Branchial regions obliquely sulcate. Rostral horns short, rather narrow, and widely separated. Inner angle of orbit prominent, acute. Antero-lateral margin with four small teeth, often tuberculiform. Basal joint of antenna very broad, with an antero-external spine, not exceeding upper preorbital tooth. Arm tuberculous, two spiniform teeth on inner margin; wrist smooth, two tubercles on inner margin; palm somewhat dilated; fingers gaping; a tooth on dactylus near its base; sometimes a smaller one on pollex near spoon. Ambulatory legs a little rough, sparsely hairy, hairs fine and chiefly on last three joints.

Color, yellowish, with a large brown spot covering a large part of the cardiac region. Claws and feet spotted with brown and white; often the dark shade forms a broad band on the hand, whence the specific name.

Dimensions of male: Length, 18.2 mm.; width, 17.7 mm.

Gulf of Mexico; Florida Reefs; West Indies; Curaçao. Guanica Bay, Porto Rico, on coral reef.

Mithrax forceps (A. Milne-Edwards).[1]

Mithraculus forceps A. Milne Edwards, Crust. Rég. Mex., 109, pl. XXIII, f. 1, 1875.
Mithraculus hirsutipes Kingsley, Proc. Boston Soc. Nat. Hist., XX, 147, 1879; Proc. Acad. Nat. Sci. Phila., XXXI, 389, pl. XIV, f. 1, 1879.
Mithrax forceps Miers, *Challenger* Rept., Zool., XVII, pp. 87, 88, 1886.

Carapace comparatively smooth, large specimens with scattered punctures, small ones deeply sculptured. Three grooves run diagonally backward from near first, second, and fourth sinuses of lateral margin; of the intervening ridges thus formed, the two anterior are not broken up into lobules, as in *M. sculptus*. Six or seven depressed tubercles along margin and on posterior part of branchial region, two or three along outer margin of hepatic region, and two pairs on frontal region directly behind lobes of rostrum. Median notch of front broadly V-shaped. Antero-lateral teeth four, acute, slender, separated by broad rounded sinuses, the first the shortest and in large specimens subacute, the remainder sharp and directed forward, the second usually the longest and largest. Sometimes a small postero-lateral tooth. Arm with five spines or spiniform tubercles on upper margin, two on inner face just below margin; on the inner margin two prominent teeth. Carpus smooth, sometimes unarmed, often with a short spine or tubercle on inner margin anterior to inner angle, giving appearance of a double tooth. Fingers widely gaping in male; dactylus with a large tooth one-third distance from proximal end, or instead a few minute teeth; the pollex may have from one to three small teeth or tubercles in the middle. Ambulatory legs distinctly spiny and fine-hairy.

Color, cinnamon or reddish-brown.

Dimensions of male: Length to base of rostral lobes, 30.5 mm.; width, without spines, 35 mm.

From North Carolina to the Abrolhos Islands, Brazil; Bermudas; in 1 to 17 fathoms. Porto Rico: Mayaguez Harbor; off Gallardo Bank, 10 fathoms, station 6076; off Vieques, 6 to 16 fathoms, stations 6085, 6091, 6092, 6096; off Culebra, 15 to 15¼ fathoms, stations 6087, 6093; off Humaçao, 9½ to 12½ fathoms, stations 6098, 6099.

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[1] Mr. Rankin, in Ann. N. Y. Acad. Sci., XII, 532, 1900, uses the name *M. hirsutipes* Kingsley as having priority. The Crustacea of the Mission Scientifique, by A. Milne Edwards, appeared in sections from 1873 to 1880, as indicated on the wrappers of the separate parts. According to the Bibliographie de la France for 1875, pp. 57 to 120 (including the description of *M. forceps*) were issued December 4 of that year.

Mithrax sculptus (Lamarck).

Maia sculpta Lamarck, Nat. Hist. Anim. sans Vert., v, 242, 1818.
Mithrax sculptus Milne Edwards, Mag. Zool., II, pl. v, 1832.

Carapace broader than long, with rounding margins. Front broad, little advanced, formed of two small tubercles separated by a narrow notch. Inner orbital angles obtuse and very slightly produced. The orbital border bears three small tubercles—one superior, one external, the other inferior. Basal article of antenna very wide, much expanded outwardly, forming a part of floor of orbit; its antero-external angle is tuberculiform and scarcely more advanced than superior inner orbital angle. Posterior two-thirds of the carapace nodose; branchial regions crossed by oblique sulci, the intervening elevations being broken up into irregular lobulations. Antero-lateral margins cut into four rounded lobes, which in the young are more or less pointed. Carapace and chelipeds naked and shining.

Chelipeds enlarged in the male; the arm has two spiniform tubercles in front; carpus smooth; hand compressed; dactylus as long as palm; fingers widely gaping, each provided with a large tooth, that is near the base in the dactylus, but in the middle of the gape in the pollex; in the female the fingers gape less and are without large teeth. Ambulatory legs somewhat spinous and covered with a brush-like coating of stout and slender setæ.

Color, sage green or bluish green, in alcohol.

Dimensions of male: Length, 21.2 mm.; width, 24.2 mm.

Bahamas; Florida Keys to Brazil, to a depth of 20 fathoms; abundant on coral reefs. Porto Rico: Boqueron Bay; Guanica Bay, on coral reef; Ponce reefs; Arroyo; Caballo Blanco Reef, Vieques; Ensenada Honda, Culebra; Fajardo; San Juan (G. M. Gray); Aguadilla (Gundlach).

Mithrax coryphe (Herbst).

Cancer coronatus Herbst, Natur. Krabben u. Krebse, I, 184, pl. XI, f. 63, 1785. (Not *Cancer coronatus* Molina, 1782.)
Cancer coryphe Herbst, op. cit., III, Heft 2, p. 8, 1801.
Mithrax (*Mithraculus*) *coronatus* Miers, Jour. Linn. Soc. London, XIV, 667, 1879.
Mithrax coryphe Rathbun, Ann. Inst. Jamaica, I, 11, 1897.

Carapace much wider than in *M. sculptus*, about one-third wider than long; antero-lateral and postero-lateral margins forming a right angle; lobulated anteriorly as well as posteriorly, and more deeply than in *M. sculptus*. Front narrower than in *M. sculptus;* basal antennal joint much narrower. Margins of arm tuberculate; wrist uneven. Carapace and chelipeds naked except on the frontal lobes, but not shining.

Dimensions of male: Length, 14 mm.; width, 19.4 mm.

Bahamas; from Florida to Brazil to a depth of 30 fathoms. Porto Rico: Puerto Real; Boqueron Bay, on coral reef; reefs at Ponce; Arroyo; Ensenada Honda, Culebra.

Genus MICROPHRYS Milne Edwards.

Microphrys Milne Edwards, Ann. Sci. Nat. (3), XVI, 251, 1851.

Carapace broadly subpyriform and somewhat depressed, with dorsal surface uneven and tuberculated, with a small lateral epibranchial spine; preocular spine sometimes not developed. Orbits small, circular, with closed fissures. Spines of rostrum slender and more or less divergent. Abdomen seven-jointed. Eyes small. Basal antennal joint considerably dilated and armed with a long spine at antero-external angle, which is visible in a dorsal view; the movable joints and the flagella are not concealed by the rostral spines. Merus of outer maxillipeds distally truncated, the antero-external angle somewhat produced and rounded and the antero-internal angle emarginate.

Chelipeds of moderate size, with the palm compressed and more or less enlarged; fingers of the male gaping. Ambulatory legs rather short, with arms and wrists sometimes armed with spines; dactyli slightly curved.

Key to the Porto Rican species of the genus Microphrys.

A. No lateral laminiform processes on carapace. One branchial spine.......................................*bicornutus*
A′. Two lateral laminiform processes, one hepatic, the other branchial. Two branchial spines....................*platysoma*

Microphrys bicornutus (Latreille).

Pisa bicornuta Latreille, Encyc. Méth., Hist. Nat., Insectes, x, 141, 1825.
Microphrys bicornutus A. Milne Edwards, Nouv. Arch. Mus. Hist. Nat., VIII, 247, 1872; Crust. Rég. Mex., 61, pl. XIV, figs. 2–4, 1873, and synonymy.

Carapace not very hairy, all raised parts covered with rounded tubercles; a single small, epibranchial spine directed outward. No preocular spine. Basal antennal joint with a tooth on the outer margin behind spine. The line of tubercles along posterior margin is strongly curved upward near the middle. The arm has a few rounded tubercles above. Chelipeds spotted, the spots not disappearing in alcohol. Fingers moderately gaping. Ambulatory legs fringed with hair; a little rough on the margins. The species varies much in the amount of tuberculation and in the length and divergence of the horns.

Color, yellowish brown.

Dimensions of male: Length, 27 mm.; width, 21 mm.; length of horns, 4.3 mm.

Bahamas and Florida Keys to Brazil; Bermudas. A very common species on coral reefs. Porto Rico: Mayaguez, on coral reef; Mayaguez Harbor; Boqueron Bay; Puerto Real; Guanica Bay, on coral reef; reefs at Ponce; Arroyo; Caballo Blanco Reef, Vieques; Culebra; Hucares; Fajardo; San Juan (G. M. Gray coll.); Aguadilla (Gundlach).

Microphrys platysoma (Stimpson).

Milnia platysoma Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 180, 1860.
Microphrys platysoma A. Milne Edwards, Crust. Rég. Mex., 62, 1875.

Carapace depressed, tuberculate and granulate; two laminiform processes on antero-lateral margin, one on hepatic region, the other on branchial, the latter not projecting in an imbricated manner; between these processes and below their level there is a spine; two branchial spines, one of which is on the postero-lateral angle and the other farther in but on the same transverse line. On the posterior margin is a row of tubercles which grow larger toward the middle. Rostral horns slender, directed forward, about one-sixth the length of rest of carapace. Antennal spines about half the length of rostral; preocular spine acute, half the length of antennal. The arm has a dentated laminate superior crest; wrist tuberculate; palm less than twice as long as broad; fingers widely gaping, the pollex being strongly curved downward. The ambulatory legs are sparsely hairy and have a few spines and tubercles; propodal joints with a prominent rounded distal laminiform process for articulation of dactylus.

Dimensions of male from Lower California: Length, 17.2 mm.; width, 13.7 mm.; length of rostral horns, 2.5 mm.

Mayaguez Harbor, 4 to 6 fathoms, station 6065; Boqueron Bay, on coral reef; off Vieques, 14 fathoms, station 6085. This species has not before been found on the Atlantic coast. Stimpson described it from Cape St. Lucas, and Professor Bouvier records it from Lower California. The Porto Rican specimens have been compared directly with some of those collected by Mr. Diguet in Lower California.

Genus STENOCIONOPS Leach.

Stenocionops Leach in Desmarest, Dict. Sci. Nat., XXVIII, 266, 1823.
Pericera Latreille, Encyc. Méth., Hist. Nat., Insectes, x, 699, 1825.

Carapace subpyriform, rather convex, with dorsal surface uneven, tuberculated or spinous; lateral margins armed with a series of long spines; preocular spine well developed. Rostrum composed of two strong spines which are not deflexed and are divergent from base; orbits tubular, not strongly projecting; eyes small, retractile within orbits. Basal antennal joint considerably enlarged, armed with one or two small distal spines or tubercles not visible in a dorsal view. The merus of outer maxillipeds with distal margin truncate, antero-internal angle emarginate, antero-external angle rounded or subacute. Chelipeds in adult male well developed; palm elongate and subcylindrical or somewhat compressed, not dilated or enlarged; fingers either without any or with a moderate intermarginal hiatus at the base when closed. Ambulatory legs moderately elongated, with joints subcylindrical, without spines; dactyli nearly straight. Abdomen in male distinctly seven-jointed.

Stenocionops furcata (Olivier).

Cancer furcatus Olivier, Encyc. Méth., Hist. Nat., Insectes, vi, 174, 1791.
Cancer cornudo Herbst, Natur. Krabben u. Krebse, iii. pt. 4, p. 6, pl. lix, f. 6, 1804.
Pericera cornudo Latreille, Cuvier's Règne Anim., ed. 2, iv, 59, 1829.
Stenocionops furcata Rathbun Ann. Inst. Jamaica, i, 6, 1897.

Body and feet covered with dark brown hairs, some of which are stiff and hooked. Carapace not very uneven; some rounded prominences on gastric and cardiac regions; this last also with two median projections, the first very small; the other, large, suberect, and curved, overhangs the posterior border. Frontal horns large, very divergent at base; distally often subparallel or even somewhat converging; on each side a superior orbital spine. The lateral margins bear, besides the very sharp external orbital angle, four very large, sharp spines, one hepatic and three branchial. Basal article of antenna armed in front with a spine which does not reach beyond orbital border.

The chelipeds attain in the male a considerable size and are nodose; arm spined above; hand long, cylindrical, and granulate. Fingers about half as long as palm, gaping for their basal half; a tooth on dactylus near its base.

Length of large male from tip of rostrum to tip of posterior spine, 146.5 mm.; width, including spines, 93 mm.; length of rostrum, about 53 mm.; length of cheliped, 215 mm.

Mayaguez Harbor, 25 to 30 fathoms, station 6062, 2 large males, 1 large female; off Punta de Melones, 7½ fathoms, station 6072, 1 young specimen; Ensenada Honda, Culebra, 1 young specimen; off Vieques, 14 fathoms, station 6085, 1 very young. San Juan (Gundlach). Ranges from Georgia to Bahia, Brazil.

Stenocionops furcata cœlata (A. Milne Edwards).

Pericera cœlata A. Milne Edwards, Bull. Soc. Philom. (7), ii, 224, 1878.
Pericera cœlata A. Milne Edwards, Crust. Rég. Mex., 200, pl. xv A. f. 3, 1879.
Pericera cornuta cœlata Rathbun, Proc. U. S. Nat. Mus., xv, 244, 1892.

Differs from typical form of species in its more uneven carapace, in the greater divergence of the horns, which are straight, and in the relatively greater width across orbits. Not very sharply set off from *S. furcata*.

Gulf of Mexico and Caribbean Sea, 21 to 175 fathoms. Off Vieques, 15 fathoms, station 6091, one male. It is possible that some of the young specimens enumerated under *S. furcata* belong here.

Genus MACROCŒLOMA Miers.

Macrocœloma Miers, Jour. Linn. Soc. London, xiv, 665, 1879.

Carapace subpyriform, but broadened anteriorly by projecting orbits; dorsal surface unarmed, or tuberculated, or with a few long spines; margins without a series of elongated lateral spines, but often with a strongly developed lateral epibranchial spine, preceded by some smaller spines. Spines of rostrum well developed. Eyes retractile within roomy projecting tubular orbits. Antennæ have the basal joint considerably enlarged and armed distally with one or two spines. Mobile portion of antenna sometimes concealed by rostrum, sometimes exposed. Merus of external maxillipeds broader than ischium and notched at internal angle for insertion of palp. The chelipeds in the male have the palms enlarged and the fingers either arched and meeting only at tip, or in contact throughout. Ambulatory legs rather short.

Key to the Porto Rican species of the genus Macrocœloma.

A. Basal antennal joint with one spine.
  B. Carapace without a strong transverse spinous and tuberculated ridge connecting epibranchial spines.
    C. Rostral horns separated at base by a narrow sinus.
      D. Antennal spine large. Epibranchial spines short, broad, and blunt .... *trispinosum*
      D′. Antennal spine small. Epibranchial spines longer, acute .... *diacanthum*
    C′. Rostral horns separated at base by a broad U-shaped sinus .... *diplacanthum*
  B′. Carapace with a strong, transverse, spinous and tuberculated ridge connecting the epibranchial spines.. *subparallelum*
A′. Basal antennal joint with two spines .... *concavum*

Macrocœloma trispinosum (Latreille).

Pisa trispinosa Latreille, Encyc. Méth., Hist. Nat., x, 142, 1825.
Pericera trispinosa Guérin, Icon. Crust., pl. 8, f. 3; A. Milne Edwards, Crust. Rég. Mex., 52, pl. xv, f. 2, 1873.
Macrocœloma trispinosa Miers, Jour. Linn. Soc. London, xiv, 665, 1879.

Body and feet covered with very short, brown hairs which form a sort of velvet. Carapace thick and very swollen, wide at line of orbits, narrowing in hepatic portion, widening again posteriorly. The gastric region bears posteriorly a large rounded tubercle, little prominent. Some protuberances of similar nature on epibranchial lobes and on anterior cardiac lobe. Front formed of two flattened horns which at first are parallel, but separate gradually toward extremity. Inner angle of basal article of antenna surpasses greatly the frontal margin, and forms, on each side of rostral horns, a broad spine directed obliquely outward; flagellum small and hidden under front. Metabranchial lobes prolonged laterally in a strong, flattened spine directed outward and a little backward. A similar but smaller projection on middle line of posterior margin. Chelipeds of male not strong; arm long, nodose; hand relatively short; movable finger lightly furrowed above. Ambulatory legs short, feeble, and a little nodose. Length of male, 44 mm.; width, 40.5 mm.

From North Carolina to Bahia, Brazil; Bermudas. Porto Rico: Mayaguez Harbor; off St. Thomas, 20 to 23 fathoms, station 6079; off Culebra, 15¼ fathoms, station 6087; Ensenada Honda, Culebra; Aguadilla (Gundlach).

Macrocœloma subparallelum (Stimpson).

Pericera subparallela Stimpson, Ann. Lyc. Nat. Hist. N. Y., vii, 182, 1860; A. Milne Edwards, Crust. Rég. Mex., 54, pl. xiii, f. 3, 1873.
Macrocœloma subparallela Miers, *Challenger* Rept., Zool., xvii, 79, 1886.

Carapace less swollen and less thick than in *M. trispinosum*, covered, as well as feet, with a short, yellowish pubescence, in the midst of which are some longer, stiff, and hooked hairs, forming a border beginning at extremity of rostral horns and continued to branchial regions. Rostral horns almost parallel, curving down a little and separated to base by a wide, deep sinus. Inner angle of basal joint of antenna much smaller than in *M. trispinosum* and scarcely visible outside the rostral horns; flagellum small and entirely concealed. Hepatic regions more swollen than in *M. trispinosum;* metabranchial lobes produced outward and backward in two triangular spines, connected by a transverse line of elevations on branchial and cardiac regions, which increase in prominence and sharpness with age. The sternum bears some transverse, oval depressions on each article. Chelipeds strong, hand short and high. Ambulatory legs small.

Dimensions of male: Length, 40 mm.; width, 35 mm.

West Indies. Porto Rico: Guanica Bay, on coral reef; Playa de Ponce Reef; Fajardo.

Macrocœloma diacanthum (A. Milne Edwards).

Pericera dicantha A. Milne Edwards, Crust. Rég. Mex., 57, pl. xv, f. 3, 1875 (*diacantha* on plate).
Macrocœloma diacantha Miers, *Challenger* Rept., Zool., xvii, 79, 1886.

This species is intermediate between *M. trispinosum* and *M. diplacanthum;* it differs from the first in its longer, sharper, and more divergent horns, in its well-developed and very sharp postero-lateral spines, in the sharp spine on the posterior part of the urocardiac lobe, and in the width of the basal article of the external antennæ. It differs from *M. diplacanthum* in the divergence of the rostral horns, in the short spines on the margin of the orbit in front and behind, and in the character of the lateral horns, which are not enlarged at their extremity.

Dimensions of male: Length, 33.7 mm.; width, 29 mm.

Majores, 12 fathoms; Kingston Harbor, Jamaica; off Cape St. Roque, Brazil, 20 fathoms. Off Boca Prieta, Porto Rico, 8½ fathoms, station 6075.

Macrocœloma diplacanthum (Stimpson).

Pericera diplacantha Stimpson, Ann. Lyc. Nat. Hist. N. Y., vii, 183, 1860; A. Milne Edwards, Crust. Rég. Mex., 55, pl. xiii, f. 2, 1873.
Macrocœloma diplacantha Miers, *Challenger* Rept., Zool., xvii, 79, 1886.

Allied to *M. subparallelum.* The carapace, however, is narrower, more swollen, and the tubercles on the gastric, branchial, and cardiac regions are more clearly marked; rostral horns longer and more slender. Inner angle of basal article of antennæ shorter, so that it does not show in front of orbit. Orbits tubular; outer margin entire. Lateral spines of carapace wide, lamellar, bifid at their extremity, having the appearance of two spines, one above the other, soldered together; no elevated transverse ridge connecting these spines, and only a tubercle on the median line behind the carapace. Chelipeds of male longer than those of *M. subparallelum;* hands with small papillose tubercles above and inside. Ambulatory legs slender.

Dimensions of male: Length, 37 mm.; width, 29 mm.

Bahamas; West Indies. Depth, 3 to 13 fathoms. Porto Rico: Playa de Ponce Reef; Ensenada Honda, Culebra.

Macrocœloma concavum Miers.

Macrocœloma concava Miers, *Challenger* Rept., Zool., XVII, 81, pl. X, f. 2, 1886.
Macrocœloma concavum Rathbun, Proc. U. S. Nat. Mus., XXI, 576, 1898.

Body and legs covered with a short, close pubescence, with some longer curled hairs. Carapace very convex, deeply concave upon hepatic regions; dorsal surface armed with ten spines, disposed as follows: Three small spines in a triangle upon gastric region, of which the posterior and median one is the largest; two small spines on cardiac region, one on intestinal region close to posterior margin; a spine on dorsal surface of each branchial region and a rather strong lateral spine; a few tubercles in front of median gastric spine. Lateral margins of carapace tuberculated, the tubercles continued in an oblique series over pterygostomian regions nearly to antero-external angle of buccal cavity. Spines of rostrum strongly deflexed, short, flat, nearly straight, divergent, separated by a triangular interspace. The tubular orbits are laterally much elongated and bear small spines or tubercles, placed one in front of and one behind the eye, and between them above and below two tubercles. Basal antennal joint equaling in width the base of rostrum and bearing several tubercles on outer margin, and two spines, one at distal extremity and one on outer margin. Chelipeds in male rather slender and elongate, arm unevenly granulate and tuberculate on margins; wrist with a small tubercle on inner margin; palm slightly compressed, not dilated nor carinated, granulated on its inner surface; fingers about half as long as palm, bent downward, curved, meeting only toward the tips, and minutely denticulated on their inner margins.

Dimensions of adult female from station 6091: Entire length, 37 mm.; greatest width, 33.2 mm.; width at orbits, 21.5 mm.; length of rostral spines, 4.4 mm.

Brazil: Off Cape St. Roque, 20 fathoms; Bahia, shallow water (Miers); Fernando Noronha, 7 to 20 fathoms (Miers). Off Vieques, 12½ to 15 fathoms, stations 6091 and 6095.

There are three closely allied West Indian species with elongated tubular orbits and two antennal spines: *M. eutheca* (Stimpson), in which the rostral spines are separated by a U-shaped sinus, and the orbits are prolonged far beyond the antennal spines; *M. concavum* Miers, described above, and *M. intermedium* sp. nov.[1]=*M. eutheca* Rathbun, 1892,[2] not Stimpson, which, like *M. concavum*, has a triangular space between the horns, but lacks the anterior cardiac spine and has a greater breadth across the base of the rostrum.

Genus LEPTOPISA Stimpson.

Leptopisa Stimpson, Bull. Mus. Comp. Zool., II, 114, 1871.

Carapace narrow, oblong, tuberculated, with an epibranchial spine, but no lateral series of spines. Orbits complete, short, tubular. Spines of rostrum long and slender. Basal joint of antenna enlarged, armed with spines distally; movable part of antennæ very slender and partly hidden by rostrum. Buccal cavity very wide; merus of outer maxillipeds strongly dilated laterally, wider than ischium and notched at inner angle. Chelipeds slender, elongate. Ambulatory legs decreasing regularly in length, the first pair very long, last pair very short.

Closely allied to *Macrocœloma*, from which it differs chiefly in its narrow carapace, long horns, and short orbital tubes.

Leptopisa setirostris Stimpson.

Tiarinia setirostris Stimpson, Bull. Mus. Comp. Zool., II, 114, 1871.
Leptopisa setirostris Stimpson, Bull. Mus. Comp. Zool., II, 114, 1871, in text.
Macrocœloma tenuirostra Rathbun, Proc. U. S. Nat. Mus., XV, 252, pl. XXXIII, f. 1, 1892.

Carapace covered with a short pubescence, and numerous depressed tubercles; cardiac region with a prominent tubercle; mesogastric region with one less high; intestinal region with two short median spines; a short, sharp spine at postero-lateral angle of branchial region; lateral margins nearly straight, tuberculate; sides perpendicular. Orbit with a short preocular and postocular spine and an inferior tubercle on margin of antennal joint. Rostral horns about half as long as rest of carapace, slender, tapering, granulate, slightly convex to each other, leaving a narrow interspace at base and toward extremity. Basal antennal joint with two short distal spines—one at insertion of second joint, the other terminating a longitudinal ridge and just visible beside rostrum in a dorsal view. Chelipeds tuberculous; palm slightly compressed, three times as long as wide; fingers slightly gaping in male, the dactylus with a broad basal tooth. Ambulatory legs pubescent.

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[1] Type, U. S. Nat. Mus. Cat. No. 9492, off Habana, 163 fms., station 2323, *Albatross*. [2] Proc. U. S. Nat Mus., XV, 251, 1892.

Dimensions of male: Entire length, 22 mm.; length of rostral horns, 7.5 mm.; branchial width, including spines, 10 mm.; without spines, 8.5 mm.; width between tips of preocular spines, 6 mm.

Specimens were taken by the *Fish Hawk* as follows: Off St. Thomas, 20 to 23 fathoms, stations 6079, 6080; off Culebra, 15 to 15¼ fathoms, stations 6087, 6093; off Vieques, 15 to 16 fathoms, stations 6091, 6092; off Humaçao, 12½ fathoms, station 6098. Previously collected at Florida Keys, 2 to 9 fathoms (Stimpson); between Jamaica and Haiti, 23 fathoms; St. Thomas; off Cape St. Roque, Brazil, 20 fathoms.

Genus PICROCEROIDES Miers.

Picroceroides Miers, Challenger Rept., Zool., XVII, 77, 1886.

Carapace narrow and rounded behind, constricted behind the orbits, which are tubular and project laterally. The width at the orbits equals or exceeds the greatest width at branchial regions. The orbits have a long preocular and a short postocular spine and are emarginate above and below. Rostral horns long, slender, and widely separated at base. Abdomen seven-jointed and transversely ridged in both sexes; in the male the ridges correspond to similar elevations on the sternum, which are rounded and separated by deep depressions. Epistome transverse. Antennular fossettes small, deep, and well defined. Basal joint of antenna considerably enlarged and armed with an oblique keel immediately behind the next joint; following joints slender. Outer maxillipeds small; merus joint distally truncate, antero-external angle obtuse, antero-internal angle emarginate.

Chelipeds moderately elongate, rather slender; palms slightly compressed and more than twice as long as broad; fingers with an intermarginal hiatus at base. Ambulatory legs very slender and of moderate length, joints subcylindrical, unarmed; dactyli slightly arcuate.

Picroceroides tubularis Miers.

Picroceroides tubularis Miers, Challenger Rept., Zool., XVII, 77, pl. X, f. 1, 1886.

Carapace moderately convex, much longer than broad, but little dilated at branchial regions. Frontal space concave; gastric region somewhat elevated and obscurely tuberculated; the cardiac region bears a rounded prominence and the intestinal region a slender spine; the cervical and branchio-cardiac sutures are continuous and form a longitudinal sinus, separating the branchial from gastric and cardiac regions. The tubular orbits project laterally to a remarkable degree, and each bears a very long preocular and a small postocular spine, and has two notches in the inferior and one in superior margin. Rostral spines in adult male four-fifths the length of remainder of carapace; very slender, slightly curved, and remote from each other at base. The basal antennal joint has, besides the antero-internal crest, two small teeth on margin of orbit and a third on distal margin.

Chelipeds unevenly granulated; the outer surface of palm has a slight longitudinal depression near upper surface; the dactylus has a strong tubercle near its base. Carapace and ambulatory legs rather thinly pubescent; the margins of rostrum and of the free peduncular joints of antennæ have some longer hairs, some of which are clavate.

Dimensions of male: Length of rostrum, exclusive of horns, 22.5 mm.; breadth at branchial regions, 15.4 mm.; breadth between tips of postocular spines, 17 mm.

Off Habana, 33 fathoms; between Jamaica and Haiti, 23 fathoms; Fernando Noronha and Bahia, shallow water (Miers). Off St. Thomas, 20 to 23 fathoms, station 6079 (*Fish Hawk*).

Genus PITHO Bell.

Pitho Bell, Proc. Zool. Soc. London, III, 172, 1835.
Othonia Bell, Trans. Zool. Soc. London, II, 55, 1836.
Piloronus Gistel, Natur. Thierreichs, p. x, 1848. (Substituted for *Pitho* Bell, said to be preoccupied by *Pytho* Fabricius.)
Engyzomaria Gistel, loc. cit. (Substituted for *Othonia*, preoccupied).
Microrynchus Desbonne in Desbonne & Schramm, Crust. Guadeloupe, 20, 1867.

Carapace truncate in front; frontal region wide; rostrum very short, formed of two small teeth. Orbits small, tubular, and deep; eyes slender. Outer antennæ short; basal article lamellose, forming floor of orbit; second article flat, short, and broad, especially in terminal portion; third article flat, but smaller; flagellum very small. Carapace oblong-oval, antero-lateral and postero-lateral borders forming together a slightly arcuate line. Merus of outer maxillipeds dilated outwardly and very slightly notched on inner side for insertion of palpus. Chelipeds with fingers spoon-shaped; hands more or less compressed. Ambulatory legs stout and rather short; dactyli sharp and spinulous below. Abdomen of male narrow and formed of seven articles. Straight, stiff hairs border the antennæ and are arranged in a series of tufts on the pterygostomian regions.

Key to the Porto Rican species of the genus Pitho.

A. Antero-lateral teeth obtuse (in the adult): second antennal segment with its outer lobe strongly produced laterally .... *aculeata*
A′. Antero-lateral teeth acute.
  B. Carapace covered with granules tipped with hairs: lateral teeth diminishing in size from the first to last, the second and third not united at base .... *mirabilis*
  B′. Carapace with no conspicuous granules. Lateral teeth not diminishing in size from the first to last, second and third more or less united at base.
    C. Second lateral tooth much reduced. Carapace almost smooth. Chelipeds of adult male very elongate, cylindrical .... *anisodon*
    C′. Second lateral tooth but slightly reduced. Carapace tuberculate. Chelipeds of adult male less elongate, broad, heavy .... *lherminieri*

An "*Othonia nova species*, von Martens," is recorded by Gundlach from Aguadilla; it may be one of the above species.

Pitho aculeata (Gibbes).

Hyas aculeata Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 171, 1850.
Othonia aculeata Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 49, 1859; Rathbun, Proc. U. S. Nat. Mus., XV, 255, pl. XXXIV, figs. 1 and 2, 1892.
Pitho aculeata Rathbun, Ann. Inst. Jamaica, I, 7, 1897.

Carapace a little longer than broad, almost smooth above in adult, more or less tuberculous and granulous in young. Width between outer orbital angles two-thirds of entire width. Preorbital and external orbital angles subacute. Antero-lateral margins armed with five teeth (exclusive of orbital angle) more or less triangular, obtuse in the old, acute in young, the second and third coalesced at their base, the fourth and fifth small. Frontal teeth small, flat, triangular, obtuse. Basal article of antennæ wide; that portion of its anterior margin situated outside of the insertion of the second article is denticulate; a deep groove between this crest and frontal border, a second groove on the carapace parallel to first. Second article with an outer lobe much produced laterally. Chelipeds strong in the full-grown male, about 1.5 times as long as carapace; arm angular, with three depressed tubercles on upper margin; wrist with a smooth longitudinal crest; palms compressed, about 1.5 times as long as wide; fingers widely gaping for their distal two-thirds, with a tooth near base of dactyl. Chelipeds in the young male and in the female short and weak; fingers evenly dentate and in contact. The carpal joints of the ambulatory legs have a broad, deep groove on the outer surface. Appendages of first segment of abdomen in the male are brown in color for their distal half, the brown parts in contact for half their length, diverging at extremities in slight curves convex to each other, each appendage terminating in a right-angled hook, the point of which is directed toward median line of carapace.

Dimensions of male: Length, 27.5 mm.; width, 26 mm.; width across orbits, 17 mm.

Florida Keys; Bahamas; West Indies. Porto Rico: Boqueron Bay; Culebra.

Pitho anisodon (von Martens).

Othonia anisodon von Martens, Arch. f. Natur., XXXVIII, 83, pl. IV, f. 3, 1872.
Othonia lherminieri Rathbun, Proc. U. S. Nat. Mus., XV, 255, pl. XXXIV, figs. 3 and 4, 1892. (Not *O. lherminieri* Schramm.)
Pitho anisodon Rathbun, Ann. Inst. Jamaica, I, 8, 1897.

Allied to *P. aculeata*. Front much narrower, width between outer orbital angles but little more than half the entire width; rostrum more advanced and less deflexed. A slighter groove runs from tip of inner upper angle of orbit to base of rostrum. Orbital angles less advanced and less conspicuous, though more acute. Second article of antenna with a shorter outer lobe, directed forward. Antero-lateral teeth sharp, the last two of good size, the second much reduced. Carapace smoother and more pubescent. Chelipeds of full-grown male from 1.5 to nearly 2 times as long as carapace; palms longer and narrower (3 times as long as wide); arm more cylindrical, less angled and nearly smooth; wrist nearly smooth. Carpal joints of ambulatory legs longer and slenderer with a shallow groove on outer surface. Appendages of abdomen of male with the distal third of a light brown color, gradually tapering and arranged in form of a lyre, widely spreading at tips.

Dimensions of male: Length, 30.5 mm.; width, 29 mm.; width across orbits, 16.2 mm.

From Florida to United States of Colombia and Guadeloupe. Culebra.

Pitho lherminieri (Schramm).

Othonia lherminieri Schramm, Crust. Guadeloupe, 20, 1867; A. Milne Edwards, Crust. Rég. Mex., 116, pl. XXIV, f. 5, 1875. (Not *O. lherminieri* Rathbun, 1892.)
Othonia carolinensis Rathbun, Proc. U. S. Nat. Mus., XV, 256, pl. XXXV, figs. 1 and 2, 1892.
Pitho lherminieri Rathbun, Ann. Inst. Jamaica, I, 8, 1897.

Carapace rough with tubercles of different sizes, as broad as long in the adult male, longer than broad in other forms, very narrow behind in males, much wider in females. Fronto-orbital width about half the entire width in adults, wider in the young. Frontal teeth slightly more advanced than orbital angles. Second and third lateral teeth subequal; fourth and fifth much reduced. Second joint of antenna similar to that of *P. anisodon*, but wider.

Chelipeds similar to those of *P. aculeata*. Appendages of abdomen of male in contact at about three-fifths the distance from distal end, then separating slightly in faint curves concave to each other, and again converging before they finally spread out at tips; distal three-fifths yellow, very slender, tapering gradually to a fine point.

Dimensions of male: Length, 25 mm.; width, 25 mm.; fronto-orbital width, 13 mm.

Mayaguez Harbor, 97 to 120 fathoms, station 6067; off Vieques, 14 fathoms, station 6085. It is extremely doubtful if the specimen labeled "Station 6067" came from the depth indicated.

The species ranges from Charleston, South Carolina, to Cape St. Roque, Brazil, in from 1 to 20 fathoms.

Pitho mirabilis (Herbst).

Cancer mirabilis Herbst, Natur. Krabben u. Krebse, II, 152, pl. XXXVII, f. 3, 1794.
Othonia rotunda Rathbun, Proc. U. S. Nat. Mus., XV, 258, pl. XXXVI, f. 1, 1892.
Pitho mirabilis Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 258, 1898.

Carapace as broad as long, widest at fourth antero-lateral tooth, much swollen in both directions, transversely rising abruptly from bases of lateral teeth, longitudinally rising in almost an equal curve from behind the front and from posterior margin. Regions faintly indicated. Carapace covered with granules more thickly set on posterior half; long, fine hairs proceed from top of granules. Along the outer margins of the gastric lobes, bunches of granules beset with coarse hairs form a broad line which is continued to rostrum. Rostral teeth sharp, produced beyond orbital angles. Preorbital tooth obtuse, less produced than postorbital, which is subacute. Antero-lateral teeth usually five, acute, separated to their bases, the first the largest, the others as a rule decreasing in size to the last, the tips making a single curve. Anterior margins of teeth thickened. Antero-lateral margin marked by inconspicuous granules irregularly placed, giving the teeth the appearance of being themselves minutely dentate. Basal article of the antenna with a sharp, longitudinal groove through the middle; tooth at distal extremity slightly more produced than upper inner angle of orbit and visible in a dorsal view; outer lobe of second article directed forward; third article as broad as long. Abdomen and sternum minutely pubescent; abdominal appendages in male diverging slightly at distal ends, hooked at tips.

Chelipeds in both sexes slender, longer than ambulatory legs, finely punctate, upper margin with thinly scattered hairs; arm angular, a few small tubercles on the upper margin; hand slightly tapering distally; fingers in male gaping for the proximal third, a tooth on dactyl; in the female, fingers evenly dentate and in contact for nearly their whole length, a slight gape at proximal end. Ambulatory legs very hairy above, first pair reaching to about middle of manus.

Length and width of female, 17.5 mm.; width of front, 9.8 mm.

Key West; Bahama Banks. Puerto Real, Porto Rico.

Family PARTHENOPIDÆ Milne Edwards, 1834; White, 1847.

Basal joint of antenna very small and embedded between the front and the floor of the orbit. Chelipeds vastly longer and more massive than the other legs.

Key to the Porto Rican genera of the family Parthenopidæ.

A. Carapace not laterally expanded over the ambulatory legs.
B. Carapace tuberculate.
C. Carapace convex. Pterygostomian and subhepatic regions not deeply excavated............................*Lambrus*
C′. Carapace depressed. Pterygostomian and subhepatic regions excavated, this excavation forming, when the chelipeds are retracted, passages to the efferent branchial apertures ....*Platylambrus*
B′. Carapace smooth (except for a few strong spines).
C. Carapace high, without a strong lateral spine..*Solenolambrus*
C′. Carapace depressed, with a strong lateral spine ....*Leiolambrus*
A′. Carapace more or less expanded to form a vault in which the ambulatory legs are concealed.
B. Carapace greatly expanded both laterally and posteriorly. Pterygostomian region smooth, not ridged...*Cryptopodia*
B′. Carapace expanded laterally, but not posteriorly. Pterygostomian and subhepatic regions traversed by a granular ridge..*Heterocrypta*

Genus LAMBRUS Leach.

Lambrus Leach, Trans. Linn. Soc. London, XI, pp. 308 and 310, 1815.

Carapace either broadly triangular or ovate-pentagonal with short, pointed front. Surface granular, tubercular, or spiny. Eyes inclosed in distinct orbits, with a suture above and hiatus below, the hiatus occupied by the second joint of antennal peduncle. The antennules fold obliquely. Antennæ small; their basal joint, which is extremely short and does not reach the front, is wedged in between the antennulary fossa and the large lobe that constitutes floor of orbit. Buccal frame usually quadrangular, sometimes a little narrowed in front; completely closed by the external maxillipeds. Chelipeds usually of immense size and length, out of all proportion to the short, slender ambulatory legs; arm and hand usually prismatic with the borders strongly dentate; fingers much shorter than palm and abruptly curved inward and a little downward.

Lambrus agonus Stimpson.

Lambrus agonus Stimpson, Bull. M. C. Z., II, 131, 1871; A. Milne Edwards, Crust. Rég. Mex., 151, 1878, pl. XXVIII, f. 3, 1879

Carapace ovate-pentagonal, about one-fifth broader than long, with rounded sides, without angles; a moderate postorbital constriction. Depressions between regions not remarkably deep. Surface coarsely punctate or eroded, with numerous granules and tubercles; the larger tubercles more or less spiniform and arranged as follows: Five on gastric region, of which four are near the middle in a transverse line, and another, larger, on median line behind them; three in a longitudinal row on cardiac region; one on each side of urocardiac lobe; five on each branchial region, the posterior one being prolonged in a spine; one on each hepatic region. The antero-lateral margin of branchial region is armed with six small teeth; below and behind the last three is a short denticulate crest; below this, a stout spine. Rostral tooth narrow and produced; a few denticles at its base on either side. Several spines on outer margin of orbit and a small spine on upper surface of eye. A conical tubercle on each side of sternum near base of chelipeds; another on coxal joint of chelipeds. The second segment of abdomen has a sharp transverse crest, forming a lobe in the center and a tooth on each side. Chelipeds very long and slender (the arm about 1.33 times the width of the carapace), their upper surface finely rugose. An irregular row of dentiform tubercles near the middle of the upper surface of arm and wrist and nearer the outer margin of hand; inner and outer margins of arm and wrist with similar tubercles. Upon the upper margin of hand a series of eighteen or twenty irregular teeth, increasing generally in size to a point near the fingers, when they diminish; on the outer margin four to six larger teeth and many intermediate smaller ones. Ambulatory legs long, for the genus (the first one reaching end of wrist), slender, bare, and almost smooth, having only some faint indications of spinules on upper margins of meral joints.

Dimensions of male: Length of carapace, 17.5 mm.; width, 20.8 mm.

Gulf of Mexico; Florida Reefs and Caribbean Sea; 25 to 84 fathoms. Mayaguez Harbor, 75 to 76 fathoms, station 6063.

Genus PLATYLAMBRUS Stimpson.

Platylambrus Stimpson, Bull. Mus. Comp. Zool., II, 129, 1871.

Closely allied to *Lambrus*, of which it may be only a subgenus. Carapace strongly carinated or tuberculated, broadly triangular (considerably broader than long), with rounded sides and a broad but sharp-pointed projecting rostrum; no postocular constriction. Chelipeds with arm and hand straight, sharply trigonal, the edges of these joints, as also outer edge of carpus, being very sharply and stoutly serrated. In the typical species the carapace is much flattened and the pterygostomian and subhepatic regions strongly excavated quite to the infero-exterior margin of the orbit, forming, when the chelipeds are retracted, covered afferent passages, the external apertures of which are seen between the base of the finger of cheliped and margin of orbit.

Platylambrus serratus (Milne Edwards).

Lambrus serratus Milne Edwards, Hist. Nat. Crust., I, 357, 1834.
Platylambrus serratus A. Milne Edwards, Crust. Rég. Mex., 156, pl. xxx, f. 1, 1878, and synonymy.

Carapace about 1.5 times as broad as long, depressed; the furrow separating the gastric from the branchial regions is deep; elevations of the carapace ornamented with numerous unequal tubercles, some of which on the branchial region are sharp. Rostrum short and narrow. Antero-lateral margins cut into seven or eight triangular teeth, and terminating posteriorly in a large flat spine, directed nearly straight outward. Postero-lateral border armed with three short erect spines, the last of which limits the posterior border. A large median tubercle on posterior border. Chelipeds long (the length of arm equaling width of carapace without spines) and flattened; lower face smooth; outer margin cut into triangular, sharp teeth, of which nine, alternately large and small, are on the hand; teeth of inner margin smaller and more numerous (15 or 16 on the hand); upper surface showing a few tubercles on the hand, but more on the arm, where there is an obliquely longitudinal row. The first ambulatory leg does not reach end of arm; these legs are slightly spinulous, but in the main, smooth.

Color, rosy gray, sometimes spotted with black; fingers carmine, teeth bordered with black (A. Milne Edwards).

Dimensions of male: Length, 18.5 mm.; width, 27.8 mm.

From North Carolina to Gulf of Mexico and West Indies, 5 to 30 fathoms. Mayaguez Harbor, 1 young male.

Genus LEIOLAMBRUS A. Milne Edwards.

Leiolambrus A. Milne Edwards, Crust. Rég. Mex., 148, 1878.

Carapace hexagonal, considerably broader than long, with a strong spine near middle of its lateral margin. Surface depressed, smooth, or nearly so, with three low longitudinal elevations, one median, the others branchial. Front subtruncate, with a minute median point. Orbits with a closed fissure above, a large V-shaped fissure below toward outside, and an inner hiatus in which is lodged the antenna. Basal joint of antenna very small. Antennules folding almost longitudinally. Buccal frame narrowing a little forward, loosely covered by external maxillipeds; these last have an anteriorly tapering ischium, a merus with a semicircular antero-external outline, antero-internal angle rectangularly notched; merus and ischium of the endognath (not the exognath) bordered with long hairs which form a ventral covering to the afferent channels of the branchiæ. Chelipeds very long, sharply trigonal, somewhat unequal; marginal teeth small and numerous. The fingers gape in the larger claw. First pair of ambulatory legs the shortest.

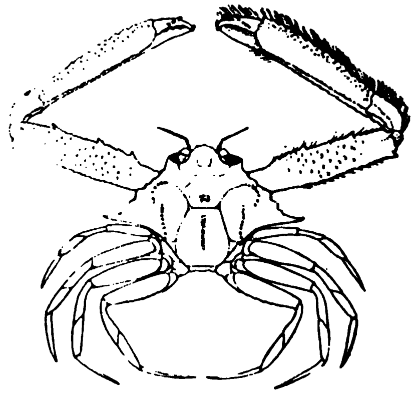


FIG. 12.—*Leiolambrus nitidus*, male, × 2.5.

Leiolambrus nitidus, sp. nov.

Carapace about three-fifths as long as broad, antero-lateral and postero-lateral margins subequal; the surface is coarsely punctate in elevated regions, smooth in depressions, a little granulous along summit of branchial, cardiac, and posterior part of mesogastric. Margin of front feebly tridentate, not advanced beyond antennular fossettes. Orbits wider than long and completely filled by large eyes. Antero-lateral margin obscurely toothed, the teeth having denticulate margins. Lateral spine strong, acuminate, directed either outward or somewhat backward, and slightly upward. A small tubercle on postero-lateral margin at end of branchial ridge. Extremities of posterior margin either angular or marked with a small tooth. Inner lobe of orbital floor produced nearly to line of front. Chelipeds narrow, lower surface smooth, upper surface with a scant marginal fringe of hair. Arm with upper surface convex and scabrous, anterior margin armed with many small denticulated teeth, of which three or four are noticeably larger and sometimes spiniform; posterior margin evenly denticulate and terminating in a spine. Outer margin of wrist denticulate, inner margin granulate, a longitudinal line of granules through middle of upper surface. Hand with denticulate inner and outer margins, with granules along outer margin of upper surface. Thumb not bent down or in, prehensile edge with three or four large teeth. Movable finger spinulous on upper surface; a spine at terminal third directed distally; prehensile edge finely toothed. Fingers of larger claw with a small gape. Last three pairs of ambulatory legs reaching beyond end of arm; first pair barely reaching dactylus of second. Legs almost smooth; lower margins of meral joints very finely denticulate. The third, fourth, and fifth abdominal segments in the male fused; all separate in the female.

Male: Length of carapace, 6.4 mm.; width, 10.3 mm.; length of cheliped, about 20 mm.

Mayaguez Harbor, 12 to 18 fathoms, station 6061; 3 males, 5 females, types (Cat. No. 23776). Mayaguez Harbor, 7 to 12 fathoms, stations 6058, 6059, and 6060; San Juan Harbor, 4½ to 5½ fathoms, station 6054.

Up to this time no representative of this genus had been taken in the Atlantic; the type species, *L. punctatissimus* (Owen), from Lower California, has a much smaller lateral spine, larger postero-lateral and posterior spines, and smaller orbits.

Genus SOLENOLAMBRUS Stimpson.

Solenolambrus Stimpson, Bull. Mus. Comp. Zool., II, 132, 1871.

Carapace pentagonal, more or less broad than long; posterior side of pentagon much the shortest, the other four sides about equal. Margin acute on all sides, forming a slight crest. The upper surface is naked, glossy, strongly convex,and bears four protuberances—one gastric, one cardiac, and two branchial. Gastric and cardiac protuberances more or less triangularly pyramidal; branchial protuberance armed with an acute ridge running obliquely to postero-lateral margin of carapace. Frontal region slightly convex, no protuberance on orbital region. Rostrum short and blunt or faintly tridentate. Orbits round, a closed fissure above. Basal joint of external antennæ about as long as next joint. Epistome concave. From the antero-external angle of the buccal area a sharp, elevated, crenulated ridge extends to outer base of cheliped, separating concave pterygostomian from subhepatic region, which is also concave and channel-like. When retracted, the extremity of hand of cheliped covers pterygostomian region, forming the afferent passage. External maxillipeds fit accurately the buccal area and closely against each other within; exognath concave, forming part of wall of afferent channel, which is defined within by a slight, elevated ridge on outer side of ischium of endognath; the merus has a prominent antero-external angle, its surface concave toward antero-interior angle; no notch for insertion of palpus, which, except at origin, is concealed behind the other joints of endognath. The chelipeds resemble those of *Lambrus*, except that the fingers are very small and the dactylus is generally at right angles with palm when retracted. Terminal joints of ambulatory legs acuminate. Third, fourth, and fifth joints of male abdomen soldered together.

Key to the Porto Rican species of the genus Solenolambrus.

A. Postero-lateral margin of carapace unarmed between branchial ridge and posterior margin .... *typicus*
A′. Postero-lateral margin with a spine between branchial ridge and posterior margin .... *decemspinosus*

Solenolambrus typicus Stimpson.

Solenolambrus typicus Stimpson, Bull. Mus. Comp. Zool., II, 133, 1871; A. Milne Edwards, Crust. Rég. Mex., 159, 1878; pl. XXVIII, f. 4, 1879.

Carapace one-eighth broader than long. Surface coarsely punctate. Protuberances of gastric and cardiac regions triangularly pyramidal and acute, with the ridges forming the angles crenulated; the posterior ridge in the median line of carapace, the other two diverge from each other in front. Cardiac pyramid symmetrical, each of its triangular sides being equal; gastric protuberance not symmetrical, the posterior ridge being a short, steep slope, the two anterior ridges being long and inclosing a gradual, somewhat convex, slope toward front. Ridge of branchial region also crenulated and bent at middle at an obtuse angle, almost a right angle. In the male each protuberance of carapace is surmounted by an acute spine, while in the female the apical angles are not thus acute. Margin of carapace more or less distinctly crenulated, especially antero-lateral margin, at the outer or posterior end of which are three small and not very well-marked teeth. Antero-lateral margin concave anteriorly, convex posteriorly. Posterior margin straight, lateral angles sharply defined and even spiniform in male. Eyes rather large, with a minute tubercle on anterior side of extremity. Basal joint of external antennæ somewhat longer than next joint. Epistome of moderate length. External maxillipeds naked; ischium tuberculated near outer margin and near extremity. Sternum with a few tubercles between bases of chelipeds. Chelipeds long, naked, except some inconspicuous setæ on crest of hand. Merus with denticulated margins and with surface above for the most part smooth and glossy, but with a few tubercles near the margins. Carpus with five denticulated crests. Hand trigonous, with ten strong teeth on inner crest, twelve to fourteen small granulated teeth on outer margin, and fifteen teeth increasing regularly in size toward extremity on lower margin; upper surface with two rows of tubercles, inner surface with two rows, and outer surface with three rows; all the tubercles ornamented with from two to five granules. Fingers very small, between a fourth and a fifth the length of palm; dactylus when flexed almost at right angle with palm. Ambulatory legs compressed, naked, polished, with a laminiform crest above; the merus joints of posterior pair have a crest below, which has a lobe-like expansion at inner extremity. Abdomen tuberculated at sides, that of male tapering slightly.

Dimensions of male: Length, 9.2 mm.; width, 10 mm.

Mayaguez Harbor, 75 to 76 fathoms, station 6063; off Punta de Melones, 8 fathoms, station 6073. Previously collected at Little Bahama Bank; Gulf of Mexico; Florida Reefs; Cuba; in depths of 50 to 338 fathoms.

Solenolambrus decemspinosus Rathbun.

Solenolambrus decemspinosus Rathbun, Proc. U. S. Nat. Mus., XVII, 84, 1894.

Closely allied to *S. typicus*. Antero-lateral margin convex; area between the two anterior gastric ridges narrower than in *S. typicus;* gastric and cardiac prominences terminating in slender spines. Eight additional dorsal spines—two on each branchial ridge, of which the posterior or marginal is the longer, one at each posterior angle, and one on postero-lateral margin midway between the last and branchial spine. Surface finely punctate. Sternum smooth between bases of chelipeds. Terminal segment of abdomen of male much longer and distally narrower than in *S. typicus*, its sides deeply concave. Merus of the outer maxillipeds narrower and more produced at antero-external angle than in *S. typicus*. Chelipeds similar to those of *S. typicus*. The second, third, and fourth pairs of ambulatory legs more or less cristate below.

Dimensions of male: Length, 6 mm.; width, 7 mm.

Off entrance to San Juan Harbor, 45 fathoms, station 6051, 1 male. Gulf of Mexico, 60 fathoms (type locality).

Genus CRYPTOPODIA Milne Edwards.

Cryptopodia Milne Edwards, Hist. Nat. Crust., I, 360, 1834.

Carapace very broadly triangular, with very large lateral clypeiform vaulted expansions which conceal the ambulatory legs and are prolonged posteriorly far beyond base of abdomen. A ridge extends from gastric region across branchial region to the postero-lateral margin. Rostrum nearly horizontal, spatuliform and very prominent. Pterygostomian regions smooth, not ridged. Orbits very small, nearly circular, with a suture in superior margin. Epistome well developed; antennulary fossæ narrow and somewhat oblique. Eyes very small and retractile. Basal antennal joint slightly dilated, not nearly reaching internal orbital hiatus, which is filled by the second joint. Buccal cavity and external maxillipeds small. Merus of maxillipeds distally truncated, antero-external angle produced. Chelipeds allied to those of *Lambrus*. Ambulatory legs with the fourth, fifth, and six joints more or less cristate.

Cryptopodia concava Stimpson.

Cryptopodia concava Stimpson, Bull. Mus. Comp. Zool., II, 137, 1871; A. Milne Edwards, Crust. Rég. Mex., 168, pl. XXIX, figs. 1 and 2, 1878.

Carapace a little broader than long; antero-lateral margins twice as long as postero-lateral and meeting them at an obtuse angle; postero-lateral margins converging posteriorly very slightly, posterior margin straight in female, very slightly emarginate in male. Gastro-branchial ridges granulate;

margin cut into small truncate teeth separated by closed fissures and with denticulate margins. The lateral expansions do not quite cover the feet when extended. Surface smooth and shining. Front triangular and flattened. Merus of maxillipeds triangular, its internal angle truncate. Upper surface of arm and hand of cheliped dilated toward middle; margins with a few obscure teeth, also denticulate. Crests of legs denticulate. Sternum very concave in front; a deep hollow fits terminal segment of abdomen; on each side of this hollow is a strong dentate crest prolonged to basal article of cheliped.

Dimensions of male: Length, 6.5 mm.; width, 7.7 mm.

Off St. Thomas, 20 fathoms, station 6080, 1 female (*Fish Hawk*). Gulf of Mexico, Florida Keys, and Bahama Banks, 19 to 34 fathoms.

Genus **HETEROCRYPTA** Stimpson.

Heterocrypta Stimpson, Ann. Lyc. Nat. Hist. N. Y., x, 102, 1871.

Differs from *Cryptopodia* in having posterior border of carapace slightly overlapping abdomen but not distinctly produced; lateral clypeiform expansions less produced, so that the legs when even moderately extended can be seen beyond them; pterygostomian and subhepatic regions traversed by a granular ridge which runs parallel to antero-lateral border from angle of buccal cavity to base of chelipeds.

Key to the Porto Rican species of the genus Heterocrypta.

A. Length of carapace two-thirds or less of the width .... *granulata*
A′. Length of carapace nine-tenths of the width .... *lapidea*

Heterocrypta granulata (Gibbes).

Cryptopodia granulata Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 173, 1850.
Heterocrypta granulata Stimpson, Ann. Lyc. Nat. Hist. N. Y., x, 102, 1871.

Carapace very wide, length two-thirds the width; the branchial ridge runs almost parallel to antero-lateral margin, except on gastric region, where it is transverse; from either end of this transverse portion a longitudinal crest runs forward to upper margin of orbit. A large dome-like elevation on cardiac region, granulated at summit. General surface smooth and punctate; margins crenulate. Portion of margin between antero-lateral margin and the branchial ridge straight. The posterior margin forms with the preceding an angle scarcely perceptible except in a rear view. Rostrum broad, blunt, and deflexed, margins rounded. Lower surface is granulous. Merus of outer maxillipeds notched at inner angle. Chelipeds unequal, rather short and heavy. Upper surfaces of arm and hand dilated toward middle; margins irregularly denticulate. Fingers of larger cheliped gape, those of smaller do not. Merus of last pair of feet barely visible in a dorsal view. Third, fourth, and fifth segments of abdomen of male are fused; sixth segment has a sharp posterior, appressed spine, the tip of which lies between two tubercles on fifth segment.

Dimensions of female: Length, 14.5 mm.; width, 21 mm.

Vineyard Sound to the west coast of Florida; West Indies. Mayaguez, 1 male.

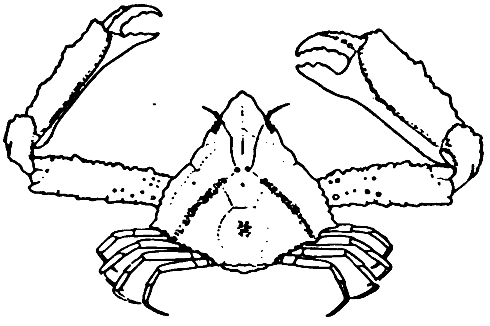


FIG. 13.—*Heterocrypta lapidea*, female, × 4.

Heterocrypta lapidea, sp. nov.

Carapace much narrower than in *H. granulata*, the length being nine-tenths of the width; some of the granules of branchial ridges are thrown up in tubercles, one at gastric terminus of either ridge; a well-defined angle at other end of branchial ridge; margin concave between this angle and end of antero-lateral margin. A median furrow across front and anterior gastric region. Chelipeds longer and narrower than in *H. granulata;* margins of arm subparallel; dentation of margins stronger but similar to that of *H. granulata*.

Dimensions of female: Length, 5.9 mm.; width, 6.6 mm.; length of outer margin of arm and hand, each 4 mm.

One female taken at St. Thomas by the *Albatross* during a West Indian cruise (Cat. No. 20324, type). Mayaguez, 1 young specimen.

Tribe OXYSTOMATA or LEUCOSOIDEA.

Carapace with antero-lateral margins arcuate or orbiculate; sometimes subglobose or more or less oblong, with subparallel margins. Epistome much reduced. Buccal frame more or less triangular, produced and narrowed forward, with margins anteriorly convergent. Six to nine pairs of branchiæ. Efferent channels opening at middle of endostome, which is produced forward. Afferent channels open either behind pterygostomian regions and in front of chelipeds, or at antero-lateral angles of palate. First antennæ folded longitudinally or obliquely. The genital organs of the male are exserted either from the bases of the fifth pair of legs or from surface of sternal plastron.

Family CALAPPIDÆ Milne Edwards, 1837; De Haan, 1837; White, 1847.

The afferent channels to branchiæ open behind pterygostomian regions and in front of chelipeds. Antennæ small. Outer maxillipeds not completely closing the buccal cavern and with the palpus not concealed by merus joint. Verges of male exserted from bases of fifth pair of legs.

Key to the Porto Rican genera of the family Calappidæ.

A. Carapace with a postero-lateral shield-like expansion or series of broad serrations, forming a vault beneath which the four ambulatory legs can be completely or largely concealed in flexion. Basal joint of antennæ much dilated.......................... *Calappa*
A′. Carapace without any trace of a postero-lateral shield-like expansion. Basal joint of antennæ slender.......... *Cycloes*

Genus CALAPPA Fabricius

Calappa Fabricius, Entom. Sys., Suppl., 309, 1798.

Carapace strongly convex, rounded in front, much broadened behind by a pair of clypeiform expansions or wings, beneath which the ambulatory legs are concealed in flexion. Front small, somewhat triangular, projecting usually little or not at all beyond level of orbits, bilobed. Orbits small, circular; eye-stalks short and thick. Antennulæ nearly vertical. Basal joint of antennæ very broad and filling a wide hiatus at inner angle of orbit. Outer maxillipeds not meeting, but leaving exposed mandibles and, in front of them, lamellar processes from first pair of maxillipeds. These processes form the bases of two channels separated by a deep vertical septum extending to antennulary fossæ. Chelipeds very large, and in flexion fitting closely the front half of carapace, forming a sort of buckler. The merus has externally and near its distal end a transverse wing-like expansion. Hand strongly compressed, its upper border forming a high dentate crest. Chelipeds equal except for the fingers, which on one hand have outside near the base a stout projecting lobule. Abdomen in adult with the third, fourth, and fifth segments fused.

Key to the Porto Rican species of the genus Calappa.

A. Posterior margin of carapace with only broad and shallow teeth.
  B. No deep hollow between gastric and hepatic regions.......................... *flammea*
  B′. A deep hollow between gastric and hepatic regions.......................... *gallus*
A′. Posterior margin of carapace with a pair of spines near the middle.......................... *sulcata*

Calappa flammea (Herbst). Plate 2.

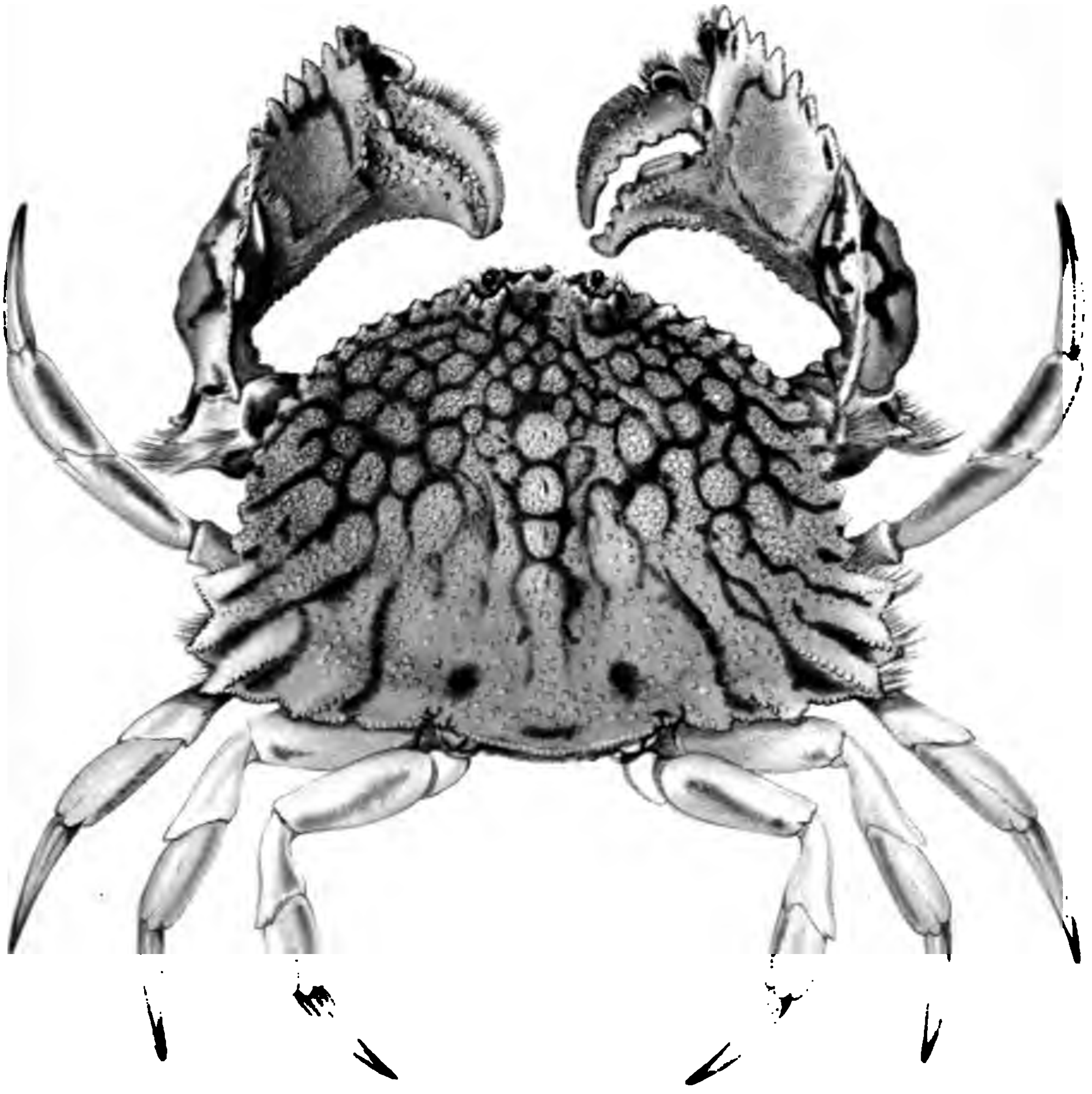
Cancer flammea Herbst, Natur. Krabben u. Krebse, II, 161, pl. XI, f. 2, 1794; III, pt. 3, p. 19, 1803.
Calappa flammea Bosc, Hist. Nat. Crust., I, 185, 1802; Miers, Challenger Rept., XVII, 284, pl. XXIII, f. 1, 1886.
Calappa marmorata Latreille, Hist. Nat. Crust., V, 392, 1803. (Not *C. marmorata* Fabricius.)

Extreme length of carapace about two-thirds extreme breadth. Carapace, outer surface of wing-like expansion of the arm, upper surface of wrist, and outer surface of palm covered with coarse granules, more closely placed on anterior than on posterior half of carapace, and forming several longitudinal rows of flattened tubercles. Antero-lateral border crenulate and granulate; posterior border, exclusive of the wings, subentire with beaded edge. Wings well developed, with seven strong teeth with beaded edges, three behind and three in front of postero-lateral tooth. Pterygostomian regions thickly covered with hair. Front with a large notch, projecting little beyond orbits. Endostomial septum extends forward in a strong tooth not reaching level of front. The wing-like expansion at end of arm is conspicuously four-lobed; the crest of palm is eight or nine-toothed; its outer face has several large tubercles and a laminate inferior proximal spine.

Dimensions of female: Extreme length, 80 mm.; width at sinus just in front of wings, 105 mm.; greatest width of carapace, 118 mm.

North Carolina to Sabanilla, United States of Colombia, and Venezuela; Gulf of Mexico; Bermudas; Cape of Good Hope; probably Indian Ocean. Porto Rico: San Juan Harbor; Mayaguez; Boqueron Bay; Arroyo; Fajardo; Ensenada Honda, Culebra; Mayaguez (Gundlach).

PARAPENAEUS AMERICANUS FEMALE NATURAL SIZE



CALAPPA FLAMMEA, MALE, NATURAL SIZE

Calappa sulcata Rathbun.

Calappa sulcata Rathbun, Bull. Lab. Nat. Hist. State Univ. Iowa, IV, 289, pl. IX, figs. 3 and 4, 1898.

Extreme length of carapace about seven-eighths its extreme width. Upper surface of carapace and outer surface of cheliped finely granulate. About seven rows of tubercles on carapace. Antero-lateral border with about fourteen crenulations, granulate on edge. Posterior margin between wings with two prominent acute spines. Wings not strongly developed, having six marginal teeth—two behind and three in front of postero-lateral tooth, which is long and spiniform. Pterygostomian regions slightly hairy. Front little projecting and with a well-defined notch. Endostomial septum with a short, sharp tooth projecting forward less than one-third distance from mouth to front. Arm expansion four-lobed. Superior crest of hand six to seven-dentate. Outer surface of palm with an irregular, oblique sulcus almost smooth, bordered by tubercles, and an acuminate inferior proximal spine.

Dimensions of female: Extreme length, 21 mm.; width at sinus just in front of wings, 23 mm.; width at posterior lateral spines, 23.8 mm.

Gulf of Mexico, 35 fathoms; off Cape Hatteras, 27 fathoms. Mayaguez Harbor, Porto Rico, 12 to 18 fathoms, station 6061, 1 female, larger than specimens previously collected.

Color in alcohol, a light pinkish brown. There are seven small and narrow rings of dark red; three on the carapace—one median encircling the third median tubercle, counting from the front; one on each branchial region, about the middle of the length of the carapace and encircling the fourth tubercle of the outermost continuous row of tubercles. There is one ring on each wrist and one on each palm near the upper margin and inclosing the tubercle toward the proximal end of the margin; this tubercle is not in the center of the ring, but near its upper periphery.

Calappa gallus (Herbst).

Cancer gallus Herbst, Natur. Krabben u. Krebse, III, pt. 3, pp. 18 and 46, pl. LVIII, f. 1, 1803.
Cancer (Calappa) gallus Latreille, Règne Anim., III, 24, 1817.
Calappa galloides Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 71, 1859.

Extreme length of carapace nearly five-sixths extreme breadth. Carapace, outer surface of wing-like expansion of the arm, upper surface of wrist, and outer surface of palm are covered with coarse tubercles, which become squamiform on posterior part of carapace. A deep hollow between gastric and hepatic regions. Antero-lateral border of carapace crenulate; posterior border finely beaded and quite unarmed. The clypeiform expansions are well developed and have each about six strong teeth with beaded edges—two teeth behind and three in front of postero-lateral tooth. The pterygostomian regions have only a few scanty hairs. Front emarginate, projecting well beyond orbits and forming a laminar rostrum. Endostomial septum extends vertically from level of front to level of mouth; its anterior border angularly convex. The wing-like expansion of end of arm is conspicuously four-lobed; crest of palm six or seven-dentate.

Dimensions of female: Length, 50.5 mm.; width at sinus just in front of wings, 54.5 mm.; greatest width of carapace, 67 mm.

Islands of the Pacific and Indian Oceans; Red Sea and Persian Gulf; West Africa; Florida Keys to Bahia, Brazil. Porto Rico: Playa de Ponce, on Light-house Reef; off Humaçao, 12½ fathoms, station 6098; San Juan (G. M. Gray, coll.).

Genus CYCLOËS de Haan.

Cycloës de Haan, Fauna Japon., 67, 68, 1837.
Cryptosoma Milne Edwards, Hist. Nat. Crust., II, 110, 1837; Brullé, Hist. Nat. Iles Canaries, II, pt. 2, Crust., p. 16, 1840.

Carapace heart-shaped or subcircular. Front rather narrow and often emarginate. Orbits large, oval, a distinct suture or a fissure in roof and two gaps in the floor, in one of which the slender basal-antennary joint is lodged. Eyes large, eye-stalks short and thick. Antennules folding obliquely. The external maxillipeds completely close buccal cavity; above them the endostomial efferent branchial channel is closed by lamellar processes from first pair of maxillipeds. The antero-internal angle of merus of external maxillipeds prolonged obliquely forward to form a prominent lobule above articulation of palp. Chelipeds similar to those of *Calappa*. Ambulatory legs compressed and of moderate size. Third, fourth, and fifth segments of abdomen in male fused together; in female all are perfectly distinct.

Cycloës bairdii Stimpson.

Cycloës bairdii Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 237, 1860.

Carapace broader than long, regularly convex; median regions well defined. Surface densely and coarsely granulate, uneven, or tuberculate. Front with U-shaped notch. Antero-lateral margin with a beaded edge, somewhat crenulate; a short tooth at lateral angle. Outer surface of chelipeds granulate and tuberculate; margin of arm expansion with two teeth; a crest on palm continuous with it. Upper margin of palm seven or eight-toothed; surface with two or three longitudinal crests of larger granules near the base.

Dimensions of male: Extreme length, 40 mm.; width, 43.2 mm.; width at lateral tooth, 40.5 mm.

Spanish Wells, Bahamas, 6 fathoms; west Florida, 21½ fathoms; Old Providence; Cape St. Lucas (type locality); Panama Bay, 33 fathoms. Ponce, 1 male, 1 female (*Fish Hawk*).

Family MATUTIDÆ McLeay, 1838.

The afferent channels to the branchiæ open behind the pterygostomian regions and in front of the chelipeds. Antennæ small. Outer maxillipeds completely closing the buccal cavern and with the palpus concealed beneath the triangular, acute merus joint. The verges of the male are exserted from the bases of the fifth pair of legs.

Genus HEPATUS Latreille.

Hepatus Latreille, Hist. Nat. Crust., III, 22, 1802.

Carapace broad, convex, regularly arcuate in front, strongly narrowing behind; hepatic regions very large, branchial regions very small. Front narrow, straight, rather prominent, and situated much above the level of the lateral border of carapace, which is prolonged beneath the orbits to join the margin of buccal cavity. Orbits small, circular, on a level with front. Antennulæ very oblique. Antennæ at inner angle of orbit. Buccal cavity very narrow forward and triangular, extending as far as level of lower border of orbits and entirely covered by outer maxillipeds, of which the merus is triangular and has straight inner margin, under which are concealed the following segments. Chelipeds strong, and when flexed fit closely against lower surface of body. Hands with a superior crest, fingers inclined a little downward and inward. Ambulatory legs smooth, unarmed. Abdomen with seven separate segments.

Hepatus princeps (Herbst).

Cancer princeps Herbst, Natur. Krabben u. Krebse, II, 154, pl. XXXVIII, f. 2, 1794.
Calappa angustata Fabricius, Entom. Syst., Suppl., 347, 1798.
Hepatus fasciatus Latreille, Hist. Nat. Crust., V, 388, 1803.

Anterior margin of front thick, obtuse. The line which descends obliquely from the external orbital angle to anterior border of carapace is faintly marked. Antero-lateral margins divided into 12 or 13 teeth more or less rectangular, and denticulate on their margins. Outer face of hands with several rows of tubercles. Dactyli with a coating of fur, excepting for a narrow, smooth line on either side. Carapace covered with small, dark-colored spots, often arranged in transversely arcuate lines.

Dimensions of male: Length, 58.5 mm.; width, 85.5 mm.; width between outer orbital angles, 18 mm.; width of front, 14 mm.

Taken at San Juan Harbor in fish trap and at Puerto Real on coral reef. Mayaguez (Gundlach.) Ranges from Georgia to Brazil; Guinea; Cape of Good Hope (Herklots); East Indies (Herbst).

Family LEUCOSIIDÆ Leach, 1819.

The afferent channels to branchiæ open at anterior-lateral angles of endostome. Antennæ small. The third maxillipeds completely close the buccal cavern and have the three terminal joints wholly concealed by the triangular fourth joint. The verges of the male are exserted from the sternal plastron.

Key to the Porto Rican genera of the family Leucosiidæ.

A. Carapace ovoid or globular, and smooth or granular, never nodular or eroded........*Persephona*
A′. Carapace polygonal, uneven, nodular or eroded.
  B. Antennulary fossæ in open communication with orbits. Carapace not produced laterally over bases of ambulatory legs........*Ebalia*
  B′. Antennulary fossæ separated from orbits. Carapace produced laterally over bases of ambulatory legs.
    C. Posterior portion of the carapace either without deep cavities, or if with cavities they are bridged over by a narrow strip extending from cardiac to branchial region........*Lithadia*
    C′. Posterior portion of the carapace with two deep, smooth cavities extending into the interior of carapace and not spanned by a narrow bridge........*Speleophorus*

Genus PERSEPHONA Leach.

Persephona Leach, Zool. Misc., III, pp. 18 and 22, 1817.

Carapace ovoid or globular, terminating posteriorly in three spines—two on, and one in the middle line immediately above, posterior border. Surface of carapace smooth or granular, never nodular or eroded, the regions not all demarcated. The front is well delimited from the carapace, and although the dentiform prolongations of the septa of the branchial channels may sometimes project beyond it, yet the whole of edge of buccal cavern is never in the adult seen beyond it in a dorsal view. Hepatic region, the side wall of which commonly forms a distinct facet, generally separated from branchial region by a broad notch in antero-lateral margin. The orbits are deep, and although the upper edge is a little emarginate, the retracted eye is completely concealed; the three sutures in the roof and outer wall are very distinct; the floor coincides with roof of buccal cavern. Antennæ loosely lodged in gap at the inner canthus of orbit. The antennules fold obliquely. Buccal cavern elongate; the acutely triangular merus of external maxillipeds is not much more than half the length of ischium measured along inner edge; the second segment of the exognath has the outer margin more or less curved. Chelipeds rather massive. Abdomen of the male consists of four or five pieces, that of female of five.

Persephona punctata (Linnaeus).

Cancer punctatus Linnæus, Sys. Nat., ed. 10. I, 630, 1758 (part).
Persephona punctata Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 70, 1859.

Carapace globular, with three sharp, recurved spines, one at either end of posterior margin and one median just above posterior margin. On the outer surface of carapace are numerous, but not crowded, granules of unequal size, most of which are visible to the naked eye. Regions of carapace ill defined. Front broadly bidentate, and the spiniform angles of the branchial channels can be seen beyond it in a dorsal view. Behind tip of front the antero-lateral boundary of carapace is formed by the side wall of the subhepatic region, which is continuous with upper surface of carapace and bounded below by a line of granules, on which, near posterior end, is a tubercle; this tubercle is smaller in the adult than in the young, where it is dentiform. Between hepatic and branchial regions is a very shallow and ill-defined notch or sinus in margin. Branchial margin marked by a line of bead granules extending as far as the posterior margin, which is on a lower level and also granulate. Maxillipeds granulate. Chelipeds rather stout, about 1.5 times the length of carapace in the adult male. Arm cylindrical and tuberculate and granulate, more coarsely above than below, and proximally than distally. Wrist and hand much smoother, very finely granulate above and below, coarsely granulate along margins. Palm nearly twice as long as wide, flattened, and a little dilated. The fingers (at least the dactylus) are as long as the palm, and curved; their edges are finely denticulate and meet for the greater part of their length. Legs stoutish; propodus of first pair reaches to end of wrist of cheliped; dactyli lanceolate and fringed with stiffish hairs. The third, fourth, and fifth segments of the male abdomen are fused.

Dimensions of male: Entire length of carapace, 36.7 mm.; width, 32.2 mm.

Mayaguez, 1 young specimen. San Juan (Gundlach). Ranges from North Carolina to Sabanilla, United States of Colombia; Gulf of Mexico.

Genus EBALIA Leach.

Ebalia Leach, Mal. Podoph. Brit., text of pl. XXV, 1817.

Carapace rhomboid or pentagonal or hexagonal, usually, but not always, a little broader than long; its regions usually well defined and tumid, tumid portions nodular or granular; its posterior margin is generally a little prominent and either bilobed or with its extreme ends dentiform. In the orbital wall there are, as usual, three sutures, and a gap at inner canthus; edge of roof of orbit considerably emarginate. The antennules fold obliquely or nearly transversely. Antennæ minute but distinct. Buccal cavern moderately elongate; the exopodite of external maxilipeds not dilated, its outer edge a little curved; triangular merus of external maxillipeds about three-fourths length of ischium measured along inner border. Chelipeds variable, usually massive; in the typical forms short, not much more than half again as long as carapace, and stout, with short, broad hands not differing much in length from the stout, compressed fingers. The abdomen of the male consists of three or four pieces.

Ebalia stimpsonii A. Milne Edwards.

Ebalia stimpsonii A. Milne Edwards, Bull. Mus. Comp. Zool., VIII, 22, 1880.

Carapace hexagonal, a trifle longer than broad; surface more even than usual in this genus; hepatic region depressed, cardiac region swollen, and surrounded by a depression; a postero-lateral lobe in transverse line with cardiac region; posterior border nearly straight, terminating in lobiform angles; surface covered with large, flat, crowded granules, larger on posterior half. Front concave, emarginate.

Chelipeds covered with granules like those on carapace; ambulatory legs slender, covered with smaller granules. Inferior surface of body also granulous.

Dimensions of female: Length, 6.5 mm.; width, 6 mm.

Mayaguez Harbor, 22 to 33 fathoms, station 6064; and 4 to 6 fathoms, station 6065 (*Fish Hawk*). Bahama Banks; west Florida, 29 fathoms; Barbados, 7 to 50 fathoms.

Genus LITHADIA Bell.

Lithadia Bell, Trans. Linn. Soc. London, XXI, 305, 1855.

Carapace subrhomboidal, with cardiac region produced posteriorly, lateral margins produced over bases of legs; surface very uneven, branchial and cardiac lobes elevated, hepatic region much depressed; the subhepatic region forms a distinct and oblique facet; surface rough with granules or tubercles. Front produced, narrow, upturned, orbits small; a considerable space between edge of lower wall of orbit and free edge of buccal cavern. The merus of external maxillipeds is much more than half the length of ischium measured along inner edge. Outer margin of second segment of exognath nearly straight. Chelipeds rather short and heavy. Abdomen of both sexes with five segments.

Lithadia pontifera Stimpson.

Lithadia pontifera Stimpson, Ann. Lyc. Nat. Hist. N. Y., x, 115, 1871.
Spelæophorus triangulus A. Milne Edwards, Bull. Mus. Comp. Zool., VIII, 23, 1880.

Carapace one-sixth broader than long in male, one-fifth broader than long in female, widest at anterior lateral angles. Branchial protuberance divided into two—one part connected by a ridge with anterior lateral tooth, the other by a thicker ridge with posterior lateral tooth. A median tuberculated ridge extending from frontal region to cardiac, interrupted at center of carapace. Between cardiac and branchial region on either side is a deep, narrow cavity, bridged over by the meeting of a projection from posterior branchial protuberance. The hepatic region is not very protuberant above and bears a short longitudinal ridge. Entire upper surface granulated. Protuberances of carapace smaller than usual, but prominent, and covered with tubercles or granules much larger than those on the depressed parts. Anterior lateral tooth (that on branchial region forming antero-lateral angle of body) is very large and prominent, and there is a smaller triangular tooth in front of it, pointing downward. Between this latter and the triangular hepatic tooth is a deep sinus. Subhepatic tooth very prominent and tuberculated. Posterior lateral tooth obtusely rounded. Posterior margin thinner than anterior and lateral margins on account of the deep excavation around cardiac region; intestinal region bilobed, but the lobes do not form dentiform projections, the posterior outline being nearly straight when viewed from above, though interrupted at middle. The front has a deep sinus at middle and is somewhat bimarginate. Epistome very short. External maxillipeds granulated. Chelipeds flattened; arm with an outer dentate crest; hand cristate outside and with a short and prominent line of tubercles on inner side near wrist. Ambulatory legs granulate and tuberculate, tubercles acorn-shaped. Sternum of male granulate, abdomen sparsely so and bearing an appressed backward-pointing spine at proximal end of penultimate segment. Abdomen of female densely tuberculate.

Dimensions of male: Length, 6.5 mm.; width, 7.5 mm. Female: Length, 11 mm.; width, 13.1 mm.

Off Culebra, 15¼ fathoms, station 6087, 1 male. Barbados (type locality); Key Largo, Florida, among corallines, low tide; off Cape Fear, North Carolina, 15 fathoms; Charlotte Harbor, Florida, 11 fathoms, and Sand Key, Florida, 125 fathoms (A. Milne Edwards).

This species, as well as *Spelæophorus elevatus*, can hardly be separated from *Lithadia*. *S. elevatus* approaches the nearest to *Spelæophorus nodosus*, the type of *Spelæophorus*, which is perhaps not a valid genus.

Genus SPELŒOPHORUS A. Milne Edwards.

Spelæophorus A. Milne Edwards, Ann. Soc. Entom. France (4) V, 148, 1865.

Carapace wide, triangular, or pentagonal, moderately convex, with the lateral borders prolonged above the bases of the legs. Posterior margin wide and having two deep and smooth cavities, one on each side, which open on the outside by two large oval orifices and are excavated far into the carapace; a suture line above and between the two openings perhaps represents the true posterior margin. Exognath of outer maxillipeds obtuse and shorter than the endognath. Chelipeds short and stout. Abdomen with five segments.

Speleophorus nodosus (Bell).

Oreophorus nodosus Bell, Trans. Linn. Soc. London, XXI, 307, pl. XXXIII, fig. 8, 1855.
Speleophorus nodosus A. Milne Edwards, Ann. Soc. Entom. France (4) V, 149, 1865.
Speleophorus nodosus Stimpson, Ann. Lyc. Nat. Hist. N. Y., X, 119, 1871.

Carapace about one-fifth broader than long, pentagonal, postero-lateral angles rounded; surface covered with crowded granules and nodose; an elevated protuberance on hepatic region, a transverse line of nodules across middle of carapace and one above each posterior cavity; a median ridge on gastric region. Hepatic region is thick, its margin rounded; subhepatic region with a prominent bunch of granules; subbranchial region with two similar bunches of granules; branchial margin with a thick anterior lobe and a sharp-edged postero-lateral lobe. Upper wall of posterior cavities thick, lower edge of this wall set in considerably from upper or external edge. Lower posterior margin of carapace bilobed, the lobes more distinctly marked in male than in female. Front thick, bilobed, somewhat bimarginate. Orbit with three closed fissures; a broad space between orbit and buccal cavity. Entire lower surface of carapace, as well as surface of chelipeds and legs, densely granulous. Merus of outer maxilliped more than half the length of ischium; exognath of nearly the same width throughout its length; its outer margin is nearly straight. Arm of chelipeds cylindrical, bilobed on outer margin, proximal lobe narrow and tuberculiform, distal broad. Hands are dilated, outer margin cristate, entire; fingers thin, flat, grooved, fitting closely together. Ambulatory legs cristate, crests dentate or narrowly lobed. The abdomen of the male has on the penult segment a backward-pointing spine at its proximal end. Dimensions of male: Entire length, 12.7 mm.; width, 14.6 mm.

Mayaguez Harbor, 4 to 6 fathoms, one female, station 6065. Type locality unknown; Jamaica (Stimpson, Rathbun); St. Thomas (Copenhagen Mus.); Guadeloupe (Geneva Mus.).

Family DORIPPIDÆ Milne Edwards, 1837; White, 1847.

Carapace short, so that the first two or three abdominal terga are completely exposed in the dorsal plane of body. The last two pairs of legs are short and feeble, and raised on the dorsal surface of carapace. Antennæ large. The verges of the male are exserted from the sternal plastron. The afferent channels to the branchiæ are found either in front of the bases of the chelipeds or not.

Key to the Porto Rican genera of the family Dorippidæ.

A. The external maxillipeds leave all the anterior part of buccal cavern uncovered.................................*Ethusa*
A′. The external maxillipeds do not leave any appreciable portion of buccal cavern uncovered...............*Clythrocerus*

Genus ETHUSA Roux.

Ethusa Roux, Crust. Médit., p. (81), 1828.

Carapace very flat, truncate-oblong and broadest behind, covering little more than first two thoracic sterna, hepatic region small. The front consists of two laminar teeth, each of which is bifid. There is a long, flat tooth or spine at antero-external angle of carapace. The antennules fold obliquely; they are large and project beyond their fossæ. The antennæ have a long flagellum; their basal joint is inserted between eye-stalk and basal antennular joint, but on a slightly lower level. The buccal cavern is elongate-triangular and does not extend to the front; the external maxillipeds cover only its basal three-fourths, but the distal part is closed in by stout foliaceous processes of first maxillipeds. The palp of external maxillipeds arises from the summit of the merus and is completely exposed in flexion. The afferent branchial orifices are wide openings immediately in front of bases of chelipeds. Chelipeds in adult male often unequal. First and second pairs of ambulatory legs long and rather stout. The last two pairs short and rather slight; they arise much higher than the other legs, and have a small hook-like dactylus folding backward. The abdomen of male usually consists of five pieces, the third to fifth segments being fused; that of female consists of seven separate segments; the first three segments are visible in a dorsal view.

Ethusa mascarone americana A. Milne Edwards.

Ethusa americana A. Milne Edwards, Bull. Mus. Comp. Zool., VIII, 30, 1880.
Ethusa mascarone americana Rathbun, Proc. Biol. Soc. Washington, XI, 109, 1897.

Carapace somewhat lyre-shaped; length about one-fifth greater than width in male, one-seventh greater in female; surface smooth and finely pubescent. Regions are well marked; branchial regions moderately swollen; they and the cardiac region are equally high. Spine at antero-external angle of carapace (also at external orbital angle) broad at base, but slender and acute, projecting obliquely forward not so far as median sinus. The divisions of the frontal teeth are sharp spines well separated and equally advanced. Eye-stalks long, rather slender, extending laterally by the full length of cornea beyond antero-external spines. Chelipeds very unequal in adult male of *E. mascarone*, probably the same in subspecies. In males which I have examined (all small) the chelipeds are feeble and equal, not so stout as next two pairs of legs. The first pair of walking legs reach to about middle of dactylus of second pair; second pair in male 2.5 times the length of carapace, in the female not so long.

Dimensions of male: Entire length of carapace, 7 mm.; width, 5.8 mm.; female, entire length of carapace, 10.7 mm.; width, 9.4 mm.

Off St. Thomas, 20 to 23 fathoms, station 6079; off Culebra, 14¾ fathoms, station 6086. Distributed from North Carolina to Florida Keys and Gulf of Mexico, 13 to 37 fathoms; St. Thomas; off Cape St. Lucas, 31 fathoms.

Genus CLYTHROCERUS A. Milne Edwards & Bouvier.

Clythrocerus A. Milne Edwards & Bouvier, Bull. Mus. Hist. Nat. Paris, v, 387, 1899.

Carapace subcircular, broadest at middle, thick, dorsally slightly convex or flat, ventrally very much swollen, posteriorly exposing the first three abdominal segments. Front short and deflexed. Eye-stalks short and rather stout, orbits well defined, with an outer tooth or spine. Antennulæ folding obliquely and completely retractile in a deep cavity between the front and the inner lower angle of orbit. The antennæ are short and partly cover the antennular cavities; their basal joint is enlarged and valviform. The buccal cavern reaches the front and is completely closed below by the outer maxillipeds, the ends of which are sometimes visible in a dorsal view. The palpus of the endognath arises from inner surface of, and is completely hidden behind, the merus. The afferent openings to the branchiæ are situated at antero-lateral angles of buccal cavity and at base of antennæ. Chelipeds stout. First and second pairs of legs slender, similar, and elongate; the last two pairs short, subdorsal, much more feeble and subprehensile, the dactylus folding back against propodus. In the abdomen of male the fifth to seventh segments are fused, in the female the sixth to seventh are fused.

A. Milne Edwards & Bouvier (*loc. cit.*) separate from *Cyclodorippe* the species *C. nitida* A. Milne Edwards, 1880, as the type of a distinct genus, *Clythrocerus*, on account of the small antennules completely retractile in the orbito-antennal cavity, and the valviform peduncle of the short antennæ, which partly covers the antennular cavity.

The species described below, as well as my *Cyclodorippe plana* and *C. granulata*, should probably be included in *Clythrocerus*, although the basal joint is not enlarged to the same extent as in *C. nitidus*.

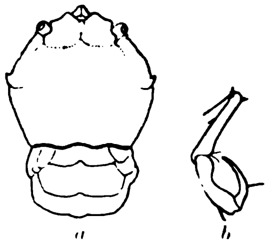


FIG. 14.—*Clythrocerus perpusillus*, female. (*a*) Outline of carapace, × 10.66. (*b*) Last two joints of fourth leg, × 15.

Clythrocerus perpusillus, sp. nov.

Carapace a little broader than long; finely and closely granulous; regions slightly marked; surface flat, the front in the same plane; two triangular, blunt frontal teeth, separated by a sinus equal to the reverse of either of the teeth; the emargination of the orbit is a quadrilateral obliquely placed; preorbital angle flat, inconspicuous; postorbital angle a little thickened, dentiform; the eye projects beyond line of orbit. A small, sharp spine, just before middle of lateral margin; half-way between this spine and the orbital angle is a slight indentation. The outer maxillipeds are long, the merus joints projecting between the rostral teeth and visible in a dorsal view. Only one cheliped on the unique specimen (the right one); it is short, about 1.5 times the length of the carapace (when flexed, not visible from above), and stout; the wrist has a prominent antero-external lobe; the hand and movable finger have an inner superior crest; fingers bent strongly inward; thumb stouter than the movable finger; they meet along their closing edges. Second pair of legs exceed the first pair by about the length of dactylus; both pairs slender and flat. In the last two pairs the dactylus is strongly curved and about as long as the curved propodus, against the base of which it fits.

This is a tiny species, the ovigerous female measuring only 2.2 mm. long and 2.5 mm. wide.

Type locality, off Vieques, 15 fathoms, station 6091; 1 female (Cat. No. 23777).

Suborder MACRURA. The Shrimps and Lobsters.

Key to the Porto Rican families of the suborder Macrura.

A. Body not compressed. Rostrum depressed, often wanting. First abdominal segment shorter and narrower than the following. Abdominal appendages not oar-shaped. The articulation between carpus and propodus at two fixed points.
  B. Third pair of feet not chelate.
    C. Pleon with segments not overlapping.................Tribe *Thalassinidea*
      D. First pair of trunk-legs unequal.................Family CALLIANASSIDÆ
      D′. First pair of trunk-legs subequal.................Family AXIIDÆ
    C′. Pleon with segments overlapping.................Tribe *Loricata*
      D. Carapace flattened; external antennæ flat, short, squamiform.................Family SCYLLARIDÆ
      D′. Carapace subcylindrical; external antennæ very long and rigid.................Family PALINURIDÆ
  B′. Third pair of feet chelate.................Tribe *Homaridea;* Family HOMARIDÆ
A′. Body more or less compressed. Rostrum usually compressed. Abdominal appendages oar-shaped. Articulation between the carpus and propodus at only one fixed point.
  B. The epimera of first abdominal segment not covered by those of second. Third pair of feet chelate, usually.
    C. Three pairs of chelæ nearly equal and not very strong.................Tribe *Penæidea;* Family PENÆIDÆ
    C′. Third pair of chelæ considerably stronger than the first and second pairs.....Tribe *Stenopidea;* Family STENOPIDÆ
  B′. The epimera of first abdominal segment covered by those of the strongly developed second segment. Third pair of feet not chelate.................Tribe *Caridea*
    C. Carpus of second pair of feet subdivided into few or many segments.
      D. Eye-stalks short and usually more or less covered by carapace.................Family ALPHEIDÆ
      D′. Eye-stalks not covered by carapace.
        E. First pair of feet more or less chelate.
          F. Rostrum small. First pair of feet moderately strong.................Family LYSMATIDÆ
          F′. Rostrum of important size. First pair of feet small.................Family HIPPOLYTIDÆ
        E′. First pair of feet simple.................Family PANDALIDÆ
    C′. Carpus of second pair of feet not subdivided.
      D. Rostrum long, usually dentate.................Family PALÆMONIDÆ
      D′. Rostrum small or wanting.
        E. First two pairs of feet subequal and similar.
          F. Fingers of first and second pairs of feet spoon-shaped. Mandibles without palp.................Family ATYIDÆ
          F′. Fingers of first and second pairs of feet not spoon-shaped. Mandibles with palp.................Family PASIPHÆIDÆ
        E′. Second pair of feet much stronger than the first.
          F. Third maxillipeds pediform.................Family PONTONIIDÆ
          F′. Third maxillipeds with the third segment strikingly broad.................Family GNATHOPHYLLIDÆ

Tribe THALASSINIDEA.

Carapace short, compressed, and marked with two longitudinal sutures. Rostrum small or wanting. Both pairs of antennæ elongated and furnished with long peduncles, those of the outer pair five-jointed and usually without a scale. First pair of feet more or less chelate; second pair often chelate; third pair always simple. Last segment of the thorax movable. Abdomen long, the segments not overlapping, the side plates feebly developed. Swimming-fan well developed. Branchiæ variable.

Family CALLIANASSIDÆ Dana, 1852.

Rostrum minute or absent. Eyes small; eye-stalks flattened, sometimes laminate; corneæ not terminal. First pair of trunk-legs unequal, perfectly or imperfectly chelate, the third and fourth pairs simple, the others variable. In the large cheliped, the carpus is formed as if it were a continuation of the propodus; carpus and propodus much wider than merus. Uropods and telson usually broad. Branchiæ filamentous, with the filaments sometimes compressed.

Key to the Porto Rican genera of the family Callianassidæ.

A. Second pair of pleopods differing from following three pairs; pleopods fringed with fine hairs.
  B. Merus and ischium of maxillipeds dilated, wider than the following joints.................*Callianassa*
  B′. Merus and ischium of maxillipeds not wider than the propodus, which is dilated.................*Glypturus*
A′. Second pair of pleopods like the following three pairs, all of these are fringed with articulated membranous filaments.................*Callianidea*

Genus CALLIANASSA Leach.

Callianassa Leach, Edin. Encyc., VII, 400, 1814.

Integument soft, except of the chelipeds. Eyes triangular or oblong; corneæ small. Flagella of antennulæ exceeding but little their peduncles. Outer maxillipeds operculiform, with the ischium and merus exceeding in width the carpus and propodus. Second pair of trunk feet chelate; fifth pair with rudimentary chelæ. Second pair of pleopods slender and filamentous; following three pairs broad and foliaceous. Pleopods fringed with small hairs.

Key to the Porto Rican species of the genus Callianassa.

A. Pollex of large cheliped without a sharp crest on outer surface .... *marginata*
A′. Pollex with a sharp crest on outer surface .... *minima*

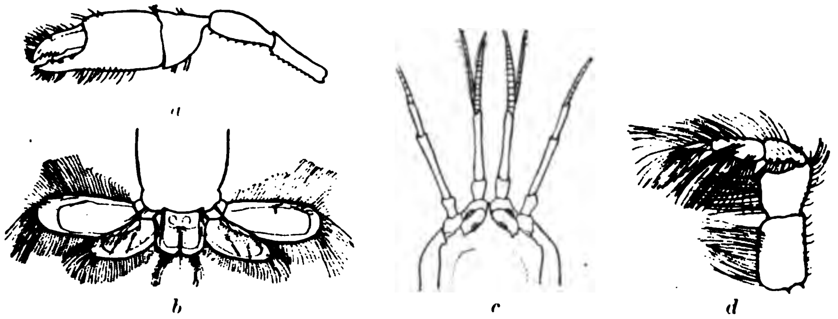


FIG. 15.—*Callianassa marginata.* (*a*) Large cheliped of a female, × 5.33. (*b*) Tail fan, × 5.33. (*c*) Anterior portion, × 5.33. (*d*) Maxilliped, × 12.8.

Callianassa marginata, sp. nov.

Carapace a little less than a third of length of body, measured from tip of rostrum to end of telson. Rostrum a conical acuminate spine extending beyond eyes. A short angular projection of the frontal margin just above antennæ. The carpal and propodal joints of the outer maxilliped do not exceed half the width of ischium and merus joints. The propodal joint in its proximal portion equals greatest width of carpal joint, but becomes narrower distally. Ischium of large cheliped armed below with irregular slender spines, which become larger toward distal end. Merus narrow, suboval, unarmed. Carpus subtriangular, with very thin, sharp margins, forming very sharp distal angles. Manus with same acute margins. Palm longer than fingers. Fingers with a few shallow teeth on their prehensile edges. The seventh abdominal segment has a median longitudinal groove and is bilobed at extremity, with a small point in the sinus between the lobes. Caudal laminæ narrow-oblong, the inner about three-fifths the length of outer. Outer branch of outer plate nearly as long as inner branch and intimately fused with it.

Length of male from tip of rostrum to tip of telson, 18.8 mm.; length of carapace, 5.7 mm.; length of hand of a smaller specimen, female, 3.6 mm.; length of palm, 2 mm.; length of carpus, 1.3 mm.

Types, Mayaguez Harbor, 161 to 172 fathoms, sand and mud, station 6066, 4 specimens, all imperfect (Cat. No. 23778). The largest lacks the chelipeds. Also taken at Mayaguez Harbor, 75 to 76 fathoms, station 6063, and in 22 to 33 fathoms, station 6064; off Aguadilla, 137 fathoms, station 6055.

This species in its unarmed, margined chelæ resembles *C. longirostris* A. Milne Edwards, from Martinique, but is distinguished by its non-terminal cornea, bilobed tail, small size, etc.

Callianassa minima, sp. nov.

Carapace about one-third the length of body. Rostrum a slender spine, a little longer than eye-stalks, and inclined downward. Cornea near end of eye-stalk. Ischial and meral joints of outer maxillipeds rather narrow for the genus, propodal joint not dilated, terminal joint oval-lanceolate. Large cheliped rather short. Ischium less than twice as long as broad and with two or three faint spinules on its lower margin. Merus oblong-oval, unarmed. Carpus subtriangular with thin upper and lower margins, the distal margin closely articulated with manus. Manus also with thin margins; palm longer than fingers, and longer than broad. Pollex with a sharp crest on outer surface, one-third the distance from prehensile edge and extending a little ways upon palm; prehensile edge with a spiniform tooth at its middle, pointing toward tips of fingers. Dactylus with a broad rounded tooth on proximal third of its cutting edge. Seventh abdominal segment oblong-triangular, with a few lateral marginal spinules on each side. Caudal laminæ oval, of about equal length and subequal to telson.

Length of male from tip of rostrum to tip of telson, 9 mm.; length of carapace, 3.1 mm.; length of manus of larger cheliped, 3 mm.; length of palm, 2 mm.; length of carpus, 0.8 m.

This species is smaller than the last and may at once be told by the crest on the pollex and the peculiar dentation of the fingers.

Types, Mayaguez Harbor, 161 to 172 fathoms, sand, mud, station 6066, 2 specimens (Cat. No. 23779). Another specimen was dredged in the same harbor in 25 to 30 fathoms, sand, mud, and shells, station 6062.

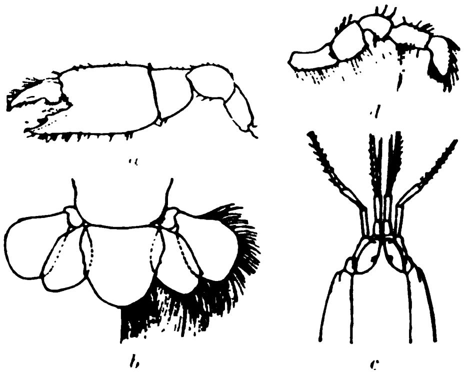


Fig. 16.—*Callianassa minima*. (*a*) Large cheliped of male, × 8. (*b*) Tail fan, × 13.33. (*c*) Anterior portion, × 15. (*d*) Maxilliped, × 16.

Genus GLYPTURUS Stimpson.

Glypturus Stimpson, Proc. Chicago Acad. Sci., I, 46, 1866; Ann. Lyc. Nat. Hist. N. Y., X, 120, 1871.

Merus and ischium of external maxillipeds not dilated, no broader than propodus and concave on outer surface; ischium armed along middle of inner surface with a sharp, prominent, spinous crest; carpus thick, and only half as broad as propodus, which is greatly dilated within, and truncated, but not grooved, at broad, anterior margin, against which the dactylus folds; dactylus rather stout, compressed, and rather longer than anterior margin of propodus. Mandibles strong, much indurated; corona with its margin unevenly toothed, deeply cleft within, and with basal process as broad and half as high as corona itself, and having also a toothed edge. Appendages to first two joints of abdomen of male nearly similar to corresponding parts in female. Caudal lamellæ deeply sculptured. Of the appendages to the penult joint of abdomen, the outer lamellæ appear as if composed of two pieces soldered together, the outer one of which overlaps inner; inner lamellæ obliquely triangular. Terminal segment of abdomen very small. (Stimpson.)

Glypturus branneri Rathbun.

Glypturus branneri Rathbun, Proc. Washington Acad. Sci., II, 150, pl. VIII, figs. 5-8, 1900.

Dorsal suture very deep. Front with a sharp, acute, depressed rostrum, and on either side above insertion of antennæ a shallower subacute projection. Eye-stalks subtriangular, with convex upper surface, and contiguous nearly to their narrow truncate extremities, which are obscurely dentate. Terminal joint of peduncle of the antennulæ about 1.4 times as long as penult joint. Antennulæ nearly as long as carapace. Peduncle of antenna more slender than that of antennula; its penult joint reaches middle of terminal joint of peduncle of antennula. Flagellum more than twice as long as that of antennula. Outer maxillipeds similar to those of *G. acanthochirus;* ischium and merus wider, propodus somewhat longer and narrower, dactylus more slender than in that species. Outer surface pubescent, inner margin long-hairy. Large cheliped finely and inconspicuously dentate on its lower margin. Merus twice as wide as ischium. Carpus nearly as wide as the manus and twice as wide as long. Palm nearly as wide as long. The fingers cross when closed. The dactylus has three teeth on prehensile edge. Smaller cheliped with carpus and manus less than half as wide as in larger cheliped, and elongate. Both chelipeds with tufts of long hair on margins. Inner caudal lamella as broad as long. Outer branch of outer lamella completely overlapping and coalesced with inner branch, and only slightly shorter.

This species can be distinguished from *G. acanthochirus* Stimpson and *G. grandimanus* (Gibbes, as *Callianassa*) by its non-spinous front and chelipeds and the subequal length of the two branches of the outer caudal lamella.

Length in median line, exclusive of antennæ, 52.2 mm.; length of carapace, 14.9 mm.; length of carpus and propodus together, measured to end of pollex, 18.5 mm.

Type locality; Mamanguape Stone Reef, Brazil. Porto Rico: Hucares, 1 male.

Genus CALLIANIDEA Milne Edwards.

Isea Guérin, Ann. Soc. Entom. France (1), I, 295, 1832. (Name preoccupied.)
Callianidea Milne Edwards, Hist. Nat. Crust., II, 319, 1837.
Callianisca Milne Edwards, Hist. Nat. Crust., II, 321, 1837.
Callisea Dana, Crust. U. S. Expl. Exped., I, 510, 1852.

Outer maxillipeds slender, pediform. Second pair of pleopods like the following three pairs; in all these pleopods the margins, instead of being fringed with small hairs or cilia, have these modified into soft and flexible articulated membranous filaments. General appearance that of *Callianassa*.

Callianidea lævicauda Gill.

Callianidea lævicauda Gill, Proc. Acad. Nat. Sci. Phila., XI, 167, 1859.

Rostrum equilaterally triangular, obtusely pointed. A less prominent obtuse tooth is above insertion of antenna; just above the tooth a closed horizontal suture runs back a little on carapace. Transverse suture on the carapace, at about two-sevenths the distance from the posterior margin, is very deep. Posterior margin produced backward at middle in a prominent lobe. The eye plates are thickened except their inner distal third, which is thin, laminate. Cornea small and protuberant and situated near outer margin. Last joint of antennular peduncle longer than penult joint. The two branches of flagellum are of about equal size near the base, the lower is a little longer and tapers to the tip, the upper is thickened in its distal portion. Thickest point at about the sixteenth segment from tip. Antennulæ nearly as long as carapace. Penult joint of antenna about 1.5 times as long as last joint. Tips of flagella broken off, but the flagella are longer than carapace.

Ischium, merus, and carpus of the outer maxillipeds wider and shorter than in the figures of *C. typa*. The merus has a small spine on its lower margin near distal end. Ischium of large cheliped compressed and dilated anteriorly with articulating surface for the merus oblique. Merus about a third longer than ischium, subovate, flat internally, convex externally above; inferior margin anteriorly tridenticulate and hairy. Carpus vertical, about twice as high as long; its posterior articulating process about as long as broad and divided into two unequal parts by a wide groove on its inner side; it projects acutely below and is there denticulate. Manus oblong, fully three times longer than carpus, with parallel borders; its interno-superior border is provided with a long row of hairs and its superior surface has a few distant fascicles of hair; inferior margin crenulated and on each side a row of fascicles of hair. Digital process of manus about two-thirds as long as manus itself and with five tubercles on its posterior half, the anterior of which is largest; anterior to this it is crenulated, as are also the margins on each side. The dactylus is curved and crosses the pollex, leaving a hiatus; above it is rounded, with a row of hairs on each side, the interior of which is very dense; below the external margin of excavation has a moderate tubercle at its middle, and posteriorly two large ones; internal border anteriorly crenulated; a few pits with fascicles of hair are between the ridges of excavation and on each side.

The second pair of feet is not only long-hairy below, but has the last three joints fringed with hair above. Fourth pair of feet compressed, the fifth subcylindrical. Terminal joint of first pair of abdominal feet lanceolate. The next four pairs of feet have two laminate branches broader and more oval than represented in *C. typa*. The cylindrical filaments with which they are fringed are composed of three joints placed end to end and not branching as in *C. typa*. The inner branch of the caudal lamella has on its carina, two spinules—one at middle, the other at distal end.

This species in its rostriform front resembles *C. mucronata* Kossmann, but is easily distinguished by the character of the abdominal filaments.

Length in median line, exclusive of antennæ, 61.3 mm.; length of carapace, 15.3 mm.; length of carpus and hand together, measured to end of pollex, 25.2 mm.

Ensenada Honda, Culebra, 1 female. Barbados, under rocks, within coral reefs (type locality).

Family AXIIDÆ Bate, 1888.

Carapace produced to a horizontally flattened point or rostrum. First pair of trunk-legs chelate and subequal; second pair small, chelate, equal; last three pairs simple. First segment of pleon very short. Swimming-fan strong. The outer branch of uropods not longer than the inner. Branchiæ filamentous, cylindrical, and compressed.

Genus AXIUS Leach.

Axius Leach, Trans. Linn. Soc. London, XI, 343, 1815.

Second joint of outer antennæ with a small, movable spine or scale.

Key to the Porto Rican species of the genus Axius.

A. Rostrum with sides unarmed except at the base.......... *defensus*
A′. Rostrum armed on one side with three spines, on the other with two.......... *inæqualis*

Axius defensus, sp. nov.

Carapace of female nearly twice as long as high, finely pubescent. Rostrum, long, narrow, acuminate, spiniform, and slightly upturned at tip, armed at base on either side with a sharp spine pointing obliquely forward and upward, just above eye. A small spine above antenna on anterior margin of carapace. From edge of rostrum a sharp lateral carina runs backward on each side about two-thirds the way to cervical suture, armed in its anterior half with two spines, the anterior the larger. The median carina extends to cervical suture, though its posterior fourth is faintly marked; there is a spine at its middle, which is broken off short in the unique specimen. Between the median and lateral crests is a submedian crest intermediate in length and armed with seven or eight irregular spines.

Eyes on short stalks, which are nearly concealed by the rostrum; cornea large and black. Peduncle of antennula overreaches rostrum by length of its last segment; flagella subequal in length and about equal to length of carapace. Distal spine on second segment of antenna at base of acicle very short, not extending beyond end of second segment. The acicle is a little longer, but also very short, not more than one-fifth the length of fourth segment, and has a small spine at its inner base. Fifth segment about half as long as fourth. Flagellum nearly twice as long as carapace. Ischium and merus of external maxilliped armed on lower edge with spines, the distal two of which are long and slender; these joints have also an inner spinous crest.

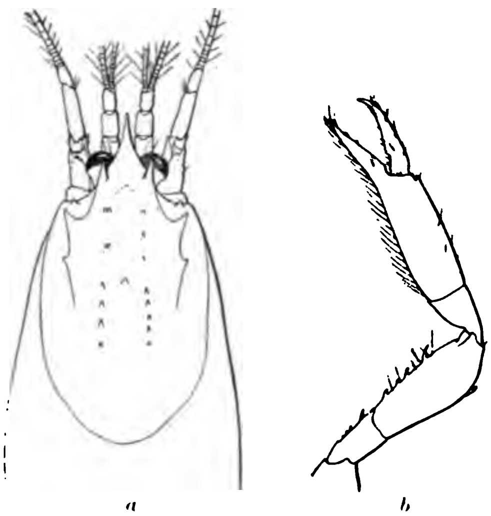


FIG. 17.—*Axius defensus*, female. (*a*) Anterior portion, × 5. (*b*) Right cheliped, × 3.5.

Chelipeds equal, about 1.5 times as long as the carapace; chelæ about two-thirds as long as the carapace. Ischium and merus armed below with spines; merus with a spine on its upper edge at distal third. Carpus a little longer than wide. Propodus compressed, with sharp edges, about two-fifths as wide as length of palm; margins subparallel; upper margin with a small distal spine. Fingers about two-thirds the length of palm, slender, tips crossing, prehensile edges finely denticulate.

The second pair of legs are slender and do not reach half the length of palm of first pair. Ischium two-fifths the length of merus; carpus three-fifths the length of merus; ischium and merus armed below with a few spines irregularly placed. Propodus a little longer than carpus, the fingers nearly as long as palm. Third and fourth pairs of legs nearly alike and longer and slenderer than the second. Carpus about half as long as propodus and two-fifths as long as merus. Dactylus about two-fifths as long as propodus. The merus has an inferior distal spine; the propodus has an inferior row of spinules. Legs of fifth pair even more slender than those of fourth and shorter than those of second. Merus and propodus subequal; carpus about half as long; dactylus about one-third of propodus.

Abdomen much narrower than carapace and not expanded in middle, the sides being nearly straight and parallel. Telson oblong, with sides slightly converging posteriorly, four-fifths as broad as long. The lamellæ of uropods a little longer than telson, longer than broad. Telson armed on lateral margin with four small spines and on dorsal surface with rows of spines extending from near center to anterior and posterior extremities of lateral margin; posterior margin emarginate and having a median spine. Inner lamella with a row of spines on its outer margin and a second row on its longitudinal carina; outer lamella with a row of spines occupying the middle third of outer margin and an oblique row extending from posterior end of marginal row inward and backward to posterior margin; also a few spines on outer half of dorsal surface.

Dimensions of female: Length from tip of rostrum to tip of telson, 28 mm.; length of carapace to tip of rostrum, 11.2 mm.; length of rostrum, 1.5 mm.; height of carapace, 5.8 mm.; width of carapace, 4.5 mm.; length of right cheliped, 15 mm.; length of merus, 5 mm.; length of propodus, 7.4 mm.; length of propodal digit, 3 mm.; length of telson, 3.5 mm.; width of telson, 2.8 mm.

Type, off Boca Prieta, 8½ fathoms, coral, sand, station 6075, 1 female (Cat. No. 23780).

This species, in its narrow, acuminate rostrum, approaches *A. armatus* Smith, but is at once distinguished by the more numerous spines of the carapace.

Axius inæqualis, sp. nov.

Allied to *A. defensus*. The rostrum while slender and acuminate is, however, armed on one side with three sharp spines, and on the other side with two. Lateral margins of rostrum continued back on carapace in a carina extending half-way to cervical suture and armed with two sharp spines, one just behind orbit. Median carina with one small spine. A short, faint submedian carina, armed anteriorly with two spinules; also a spinule between these and median carina. Eye-stalks large, dumbbell-shaped, nearly as long as rostrum, with a black cornea. The peduncle of antennula overreaches rostrum by the length of its last segment. Flagella subequal and about equal to length of carapace. Movable acicle of antenna is nearly as long as fourth segment of peduncle; spine at its base is about half as long as acicle. Armature of outer maxillipeds similar to that of *A. defensus*.

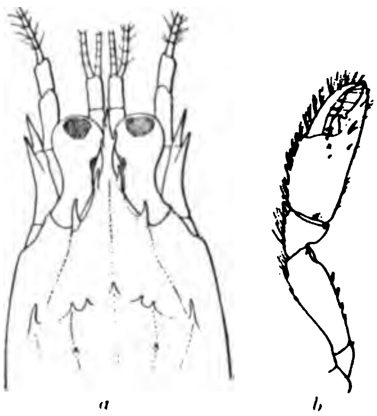


FIG. 18.—*Axius inæqualis.* (*a*) Anterior portion, × 15. (*b*) Left cheliped, × 8.

Chelipeds equal; merus armed below with slender spines, and also above on distal half; a single spine on distal outer margin. Carpus spinous above; one spine below. Manus with a row of long spines above; one spine on outer face at base of fingers; lower margin rimmed, entire. Fingers and palm subequal in length. Prehensile edges of fingers dentate; tips crossing; fingers gaping. The rostrum reaches to the middle of the carpus. Abdomen very much narrower than carapace.

Length from tip of rostrum to tip of telson, about 15 mm.; length of carapace, 6 mm.

The two specimens from which this description is made are very imperfect.

Type locality, Mayaguez Harbor, 161 to 172 fathoms, sand, mud, station 6066 (Cat. No. 23781).

Tribe LORICATA.

Body either depressed or subcylindrical. Rostrum broad and short or absent. Antennules with two flagella. Outer antennæ without a scale, first joint of peduncle fused with epistome. Trunk legs six-jointed through coalescence; none of them chelate except the last pair which is sometimes subchelate in the female. First abdominal segment devoid of appendages in both sexes. Posterior portion of telson and uropods flexible. Gills trichobranchiate.

Family SCYLLARIDÆ White, 1847.

Carapace depressed, orbits excavated in the dorsal surface. Second antennæ short, squamiform. Mandibles with a one-jointed palp. Trunk-legs simple, except the fifth pair in the female, which are minutely chelate. Branchiæ well developed; epipodal plates on the first joint in the first four pairs of trunk-legs have podobranchiæ attached to them as distinct plumes. These limbs have arthrobranchiæ, and the last four segments of the trunk have pleurobranchiæ.

Key to the Porto Rican genera of the family Scyllaridæ.

A. Exognath of outer maxillipeds without a flagellum .... *Scyllarus*
A'. Exognath of outer maxillipeds with a flagellum .... *Scyllarides*

Genus SCYLLARUS Fabricius.

Scyllarus Fabricius, Sys. Ent., 413, 1775.
Arctus Dana, Crust. U. S. Expl. Exped., I, 516, 1852.

Rostrum very short and truncate; exognath of third maxillipeds without a flagellum; pairs of branchiæ 19 in number.

Scyllarus americanus (Smith).

Arctus americanus Smith, Amer. Jour. Sci. (2), XLVIII, 119, 1869.
Scyllarus (*Arctus*) *gundlachi* von Martens, Arch. f. Nat., XXXVIII, pt. 1, 123, pl. v, f. 13, 1872.

Carapace with three blunt median prominences, two of which are on the gastric region and one on cardiac region. Anterior prominence composed of two tubercles side by side, half-way between margin of the front and the larger posterior gastric tooth. Cardiac tooth also bifid. First joint of inner antennæ short and dorsally flattened. Posterior margin of abdominal segments with a very slight median emargination. A small species, usually not more than half an inch long.

Off Vieques, 15 fathoms, station 6091. Previously taken at Egmont Key, Fla. (type locality); Cuba (von Martens); off Cape Lookout, N. C., 22 fathoms, station 2608 (*Albatross*); off Cape Fear, N. C., 15 fathoms, station 2622 (*Albatross*); Blackfish Bank, off Charleston, S. C., 12 fathoms (R. E. Earll, coll.); off Key West, Fla., 45 fathoms, station 2318 (*Albatross*); Key Vaccas, Fla., among rocks, between tides (H. Hemphill, coll.); Marco, Fla., 2 fathoms (H. Hemphill, coll.); off northwest end St. Martin's Reef, Florida Banks (J. F. Moser, coll.); Gulf of Mexico, 21 to 33 fathoms, stations 2369 to 2374, 2407 (*Albatross*), and stations 5052, 5078, 5085, 5102 (*Grampus*); St. Thomas, W. I., dredged (*Albatross*); off Cape St. Roque, Brazil, 20 fathoms, station 2758 (*Albatross*).

Genus SCYLLARIDES Gill.

Scyllarus Dana, Crust. U. S. Expl. Exped., I, 516, 1852. (Not *Scyllarus* Fabricius, 1775.)
Scyllarides Gill, Science, n. s., VII, 98, 1898.

The rostrum very prominent; exognath of the third maxillipeds ending in a flagellum; pairs of branchiæ 21.

Scyllarides æquinoctialis (Lund).

Scyllarus æquinoctialis Lund, Skrivter af Naturhistorie-Selskabet, II, 2, p. 21, Copenhagen, 1793.
Scyllarides æquinoctialis Gill, Science, n. s., VII, 99, 1898.

Carapace very convex from side to side, deflexed in the anterior portion. Lateral margins nearly parallel, with a slight indentation about one-fourth the distance from antero-lateral angle. Distance from lateral margin of carapace to inner margin of orbit about two-fifths the distance between orbits. Dorsal surface covered with flat, scale-like tubercles closely crowded together and with short, stiff bristles. Rostrum with two conical contiguous teeth. Inner margin of outer antennæ with erect, conical teeth or spines; second joint much broader than long; terminal joint suborbicular, margin crenate. First abdominal segment with two large reddish submedian spots, which unite anteriorly.

Dimensions of female from Porto Rico: Length of carapace from tip of rostrum, 114.5 mm.; width at anterior angles, 91 mm.; greatest width, 98.5 mm.; length of animal from tip of outer antennæ to tip of telson, about 29 cm.

Porto Rico: Cabo Rojo; San Juan, where it is sold in the market (Gundlach). Bermudas (T. H. Bean, coll.); Florida Keys to Brazil.

Family PALINURIDÆ Latreille 1802 (Palinurini): Leach 1814 (Palinurini).

Carapace longitudinally subcylindrical, with orbits for the eyes partially excavated. Second antennæ subcylindrical, with a long, rigid multiarticulate flagellum. Branchiæ as in the *Scyllaridæ*.

Genus PANULIRUS White.

Panulirus White, List Crust. Brit. Mus., 69, 1847.

No central rostriform tooth; the ocular segment exposed and membranous; flagella of first antennæ long and slender, and their segment produced considerably in advance of frontal margin and generally armed with strong teeth.

Panulirus argus (Latreille).

Palinurus argus Latreille, Ann. Mus. Hist. Nat. Paris, III, 393, 1804.
Panulirus argus White, List Crust. Brit. Mus., 69, 1847.

Orbital spines very large, strongly curved. Spines not very thickly placed on the carapace. Antennal segment with four spines, anterior pair a little the larger and further from posterior than are the spines of either pair from each other. Exognath of second gnathopod with flagellum reaching quite to middle of third joint. Terminal joints of trunk feet furnished with bristles. Abdominal furrows rather indistinctly interrupted at middle. Epimera with entire anterior margins, posteriorly with a sharp tooth. Color, yellowish and bluish. Abdomen with many small, yellow spots; a large, yellow spot on either side of second and sixth segments.

Length of Porto Rican specimen, measured from the anterior margin of the carapace to the tip of the telson, 42 cm.

Porto Rico: San Antonio Bridge, San Juan; Mayaguez; Boqueron Bay; Arroyo; Hucares; Cabo Rojo; Mayaguez, in the market (Gundlach). From Bahamas and Florida Keys to Brazil; Bermudas.

Tribe HOMARIDEA.

First antennæ with two multiarticulate flagella; second antennæ with a scale. Trunk-legs with seven distinct joints; the first three pairs chelate; the first pair largest. Branchiæ well developed.

Family HOMARIDÆ Bate, 1888.

Carapace subcylindrical, with a pronounced rostrum. Second antennæ with a long multiarticulate flagellum, and a scale. Segments of pleon dorsally imbricated; first segment with appendages. Outer branch of uropods with a transverse suture. Epipodal plates large, with a well-developed podobranchial plume attached to all the trunk-legs except the last pair.

Genus HOMORISCUS,[1] nov.

Rostrum depressed, short, and broad. Eyes small, but well developed. Antennal spine on anterior margin of carapace small. Antennal scale large. Second antennal segment with a spine. Thoracic feet unknown. In the character of the rostrum, this genus differs from all others of the *Homaridæ*. The rostrum resembles that of *Palinurellus*. In the small size of the eyes *Homoriscus* differs from *Homarus*, *Nephrops*, and *Eunephrops*, while the black cornea distinguishes it from *Nephropsis* and *Phoberus*. It agrees with *Nephrops* and *Phoberus* in having a large antennal scale. It is, in fact, a near relation—a little neighbor—of *Homarus*.

Homoriscus portoricensis, sp. nov.

Carapace of female slightly compressed. Rostrum triangular, acute, sides slightly convex, finely and sharply granulated; upper surface concave Carapace with seven sharp longitudinal crests: the median occupies posterior two-thirds of carapace; the submedian and supero-lateral crests begin at base

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[1] From ὁμορος, neighbor, and ισκος, diminutive suffix. By its form, the name *Homoriscus* suggests its affinity to ***Homarus***.

of rostrum and are slightly oblique, submedian equaling about half the length of carapace (exclusive of rostrum), the supero-lateral not so long; near posterior end of latter, two or three spinules; both these crests are sharply but finely granulated. The infero-lateral crest begins at antennal sinus of anterior margin of carapace and is about half as long as submedian crest. Orbit semicircular, a little wider than the black cornea which it surrounds; outer orbital angle small and acute; from it the anterior margin runs obliquely backward in a sinuous line to a notch above antenna; from this notch an inconspicuous fissure runs horizontally backward on the carapace to its posterior margin. Just outside the antenna, the anterior margin is produced to a sharp spine, the outer margin of which is thickened, and white and naked, in contrast to remainder of carapace, which is covered with a fine, close pubescence; below the white spine the anterior margin is again notched; inferior angle rounded. Antennulæ above antennæ. Antennular peduncle very short, rostrum extending to middle of its last segment. First two segments very short, third a little longer, flattened, with a small spine at anterior outer angle. Flagella subequal in length and only a little longer than rostrum. Antennal peduncle a trifle longer than antennular. The second joint extends as far forward as eye and has a spine at its anterior outer angle; it bears a large ovate scale, dentate on its outer margin with four or five spiniform teeth; inner margin fringed with long setæ. Fourth and fifth joints short, subequal, each bearing an outer distal spine. Flagellum nearly as long as the body. In fig. 19*a* the left antenna is shown in its natural position, while the right one is pulled out to show the outline of the scale.

The endognath of the outer maxillipeds has ischium and merus joints armed on inner side with spinules; merus has an outer distal spine; propodus and dactylus subequal in length and longer than carpus. The five pairs of thoracic feet missing. Abdomen narrower than carapace, gradually tapering posteriorly, smooth, punctate, slightly pubescent. Telson longer than broad, rounded at extremity, sides obscurely bispinulous, dorsal surface partly spinulous. Lateral laminæ longer than telson; inner lamina longer than outer; a transverse spinulous line across posterior half; outer half spinulous.

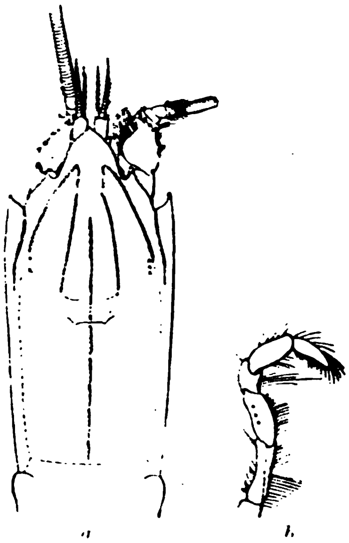

FIG. 19. *Homoriscus portoricensis*, female. (*a*) Carapace and antenna, × 10.66. *b*, Maxilliped, × 13.33.

Dimensions of female: Length from tip of rostrum to tip of telson, 14.5 mm.; length of carapace, 6.3 mm.; length of antennal flagellum, 11.5 mm.

Type locality, Playa de Ponce; 1 female (Cat. No. 23782).

Tribe STENOPIDEA.

Rostrum laterally compressed. Antennules with two flagella, antennæ with a scale. Mandibles with a three-jointed palp. Exopod of third maxillipeds is small, slender, and almost rudimentary. First three pairs of feet chelate, third pair the longest and largest. Branchiæ filamentous. First pair of pleopods one-branched and foliaceous; the uropods and telson have no transverse suture. Contains only one family.

Family STENOPIDÆ.

Genus STENOPUS Latreille.

Stenopus Latreille in Desmarest, Dict. Sci. Nat., XXVIII, 321, 1825.

Second antennæ having a long, flat, obtusely pointed scale. Third pair of legs greatly elongate and strong; fourth and fifth pairs with the antepenult joint subdivided. Telson tapering.

Stenopus hispidus (Olivier).

Palæmon hispidus Olivier, Encyc. Méth. Hist. Nat. Insectes, VIII, 666, 1811. Tabl. pl. cccxix, f. 2, 1818.
Stenopus hispidus Latreille in Desmarest, Dict. Sci. Nat., XXVIII, 321, 1825.

Rostrum with median dorsal row of six spines bifurcated at extremity, a lateral row of three to five spines on each side of rostrum; no ventral spines. Behind the sixth dorsal spine a double row.

Rostrum not reaching to end of peduncle of inner antennæ. Carapace very rough, with firm, sharp spines which are longer on dorsal than on lateral regions. Abdomen thickly armed with outwardly projecting spines. Third pair of legs long, abundantly armed with spines; propodus with about six rows of larger spines and many smaller and less regular intermediate ones.

Total length, 55.2 mm.; length of carapace, 20.2 mm.; of abdomen, 35 mm.; of rostrum to posterior margin of orbit, 6 mm.; of telson, 10.5 mm.

Between San Antonio Bridge and San Geronimo, San Juan, Porto Rico (G. M. Gray). Also occurs at Dry Tortugas, Fla.; Cuba; Jamaica; Bahamas, to a depth of 36 fathoms; Port Castries, St. Lucia; near Monosquillo, *Albatross* station 2142, lat. 9° 30′ 15″ N., long. 76° 20′ 30″ W., 42 fathoms; Bermudas; East Indies and South Pacific.

Tribe PENÆIDEA.

Body laterally compressed. First three pairs of feet usually chelate and not very strong; fourth and fifth pairs always simple. Gills dendrobranchiate.

Family PENÆIDÆ Milne Edwards, 1837 (Penéens).

Carapace at sides deeply produced and carried farther back than in the median dorsal line; rostrum laterally compressed, this part at least being carinated. Of the segments of the pleon the first three are usually not longitudinally carinate, but the three that follow are almost always much so. The sides of the first are produced so as to overlap the hind lateral margin of carapace and the front lateral margin of second segment. Telson generally dorsally flattened or grooved. Eye-stalks usually two-jointed. First antennæ with two multiarticulate flagella; the first joint of the peduncle flattened to receive the eye-stalk and laterally strengthened on the outer side by a spine-like process, on the inner by an unjointed appendage often fringed with hairs. Second antennæ with a broad, thin foliaceous scale and a long flagellum. Mandibular palp never more than two-jointed. Third maxillipeds long and pediform. Both the second and third maxillipeds and the three or four following pairs of appendages carry epipodal plates. First three pairs of trunk-legs chelate and similar, the second longer than the first, and the third longer than the second. Extruded ova not definitely attached to the appendages of the mother prior to hatching, as in most other Macrura.

Key to the Porto Rican genera of the family Penæidæ.

A. Carapace without a median dentate crest.
  B. Antennular flagella shorter than carapace.
    C. Endognath of the first maxilla greatly elongated and segmented .... *Peneus*
    C′. Endognath of first maxilla short and unsegmented .... *Parapeneus*
  B′. Antennular flagella longer than carapace .... *Xiphopeneus*
A′. Carapace with a median dentate crest .... *Sicyonia*

Genus PENÆUS Fabricius.

Peneus Fabricius, Entom. Syst., Suppl., 385, 1798.

Distal segment of mandibular palpus much larger than proximal, very broad, and not prolonged into a narrow tip. Endognath of first maxilla greatly elongated and segmented. Endopod of maxilliped slender and composed of four segments, the exopod lamellar and unsegmented; both pairs of gnathopods have well-developed epipods and large exopods; all the pereiopods have small exopods, but only the first, second, and third are furnished with epipods; a well-developed pleurobranchia on the fourteenth somite. Antennular flagellæ not longer than carapace.

Penæus brasiliensis Latreille.

Peneus brasiliensis Latreille, Nouv. Dict. Hist. Nat., XXV, 156, 1817.

Carapace with a high median carina extending almost to posterior margin; a deep and broad sulcus on either side of carina. Posterior half of carina with a median sulcus, making it bicarinate. Anterior half of carina arcuate, highest part above orbit; dentate or spinous, with nine teeth, posterior tooth almost half-way back on carapace and remote from the others, six of which are on the rostrum proper. Two or three ventral teeth on rostrum. Rostrum unarmed and horizontal toward extremity. Hepatic spine and antennal spine, carina, and groove well marked. Cervical suture extending only half-way from hepatic spine to dorsal carina. A subhorizontal suture below hepatic spine. The rostrum reaches almost to end of antennular peduncle. This peduncle is very short, stout, and hairy. Abdominal carina on fourth to sixth segments very sharp; on the sixth is a groove either side of it. Telson with a deep median groove and an acuminate extremity.

Length of Porto Rican female, 165 mm.; length of carapace, 62 mm.; of rostrum, 22.6 mm.

A very abundant species in Porto Rico as well as in other parts of tropical America.

Porto Rico: San Antonio Bridge, San Juan; San Juan Harbor between Cataño and Palo Seco; Mayaguez, seined and dredged; Mayaguez Harbor, in 7½ and 75 to 76 fathoms, stations 6058 and 6063; Boqueron Bay; Puerto Real; Guanica; Playa de Ponce; Ponce; Aibonito; Arroyo; Hucares; Fajardo. Ranges from Hudson River at Sing Sing, New York (Stimpson), to Rio Grande de Sul, Brazil (Ortmann); Harrington Sound, Bermudas (C. M. Allen, coll.); Bermudas (Verrill); West Africa. The greatest depth is recorded by Faxon, 955 fathoms, *Blake* station 29, west of Tortugas. The northern limit of this species has lately been extended by the discovery of a single specimen at Katama Bay, Marthas Vineyard, by Mr. Vinal N. Edwards, U. S. Fish Commission, September 8, 1900.

Genus PARAPENÆUS Smith.

Parapenæus Smith, Proc. U. S. Nat. Mus., VIII, 170, 1885.

Endognath of first maxilla short and unsegmented; second gnathopod without an epipod, the fourteenth somite (posterior somite of the pereion) wholly without branchiæ. Antennular flagella shorter than carapace.

Key to the Porto Rican species of the genus Parapenæus.

A. Rostrum with less than ten dorsal teeth.
  B. Sixth segment of pleon less than twice as long as fifth.
    C. Surface of pleon naked and glossy. Telson with a small spine on either side near tip .... *constrictus*
    C'. Posterior half of pleon pubescent. Telson with a long, slender spine on either side near tip .... *similis*
  B'. Sixth segment of pleon twice as long as fifth .... *americanus*
A'. Rostrum with more than ten dorsal teeth .... *megalops*

Parapenæus constrictus (Stimpson).

Penæus constrictus Simpson, Ann. Lyc. Nat. Hist. N. Y., x, 135, 1871.
Parapenæus constrictus Smith, Proc. U. S. Nat. Mus., VIII, 174, 1885.

Carapace for the most part pubescent; posterior part of branchial regions and whole of abdomen naked and glossy. Carapace carinated on its anterior three-fourths, bearing a spine behind base of rostrum. A lateral or antennal groove extends three-fifths the length of the carapace. Antennal and hepatic spines large. Rostrum reaching middle of penult joint of antennular peduncle; slightly arched, extremity slightly deflexed; armed dorsally with seven to nine equidistant teeth, diminishing in size toward extremity. Antennular peduncle rather short, extending beyond the eyes as far as length of eyes; very pubescent above. Abdomen carinated from fourth to sixth segment. Telson tapering to a short acuminate tip, armed either side with a short spine.

Dimensions of female: Length from tip of rostrum to tip of telson, 66 mm.; length of carapace, including rostrum, 26.5 mm.; length of rostrum, 10 mm.

Taken at Mayaguez and Boqueron Bay, Porto Rico. Other localities for this species are: Off Chesapeake Bay, 18 fathoms, *Fish Hawk* (Smith); off Cape Hatteras, 7 to 27 fathoms, *Albatross* (Smith); Fort Macon, N. C. (Smith); Beaufort, N. C., 4 fathoms (Stimpson); Charleston Harbor, S. C. (Stimpson); Fort Jefferson, Fla. (Kingsley); Marco Pass (Kingsley); Pensacola, Fla. (J. E. Benedict, coll.); Bermudas (Smith).

Parapenæus similis (Smith).

Parapenæus constrictus variety *similis* Smith, Proc. U. S. Nat. Mus., VIII, 175, 1885.

Allied to *constrictus*. Entire surface of carapace and of the fourth, fifth, and sixth segments of pleon covered with short, stiff setæ. Median carina of carapace extending almost to posterior margin and provided with a gastric spine, as in *constrictus*. Rostrum ascending, its anterior third almost horizontal; armed with eight or nine teeth. Antennal peduncle longer than in *constrictus*, its extent beyond the eyes being greater than length of eyes; less pubescent than in *constrictus*. Telson tapering to a very long and slender tip, armed either side its base with a long and very slender spine.

Dimensions of female: Length from tip of rostrum to tip of telson, 80 mm.; length of carapace, including rostrum, 31 mm.; length of rostrum, 13.3 mm. The Porto Rican specimens are all smaller than the above.

Taken by the *Fish Hawk* at 11 stations at the following localities: Mayaguez Harbor, 4½ to 18 fathoms, sticky mud and sand, stations 6057, 6058, 6059, 6061, abundant; Puerto Real, 8½ fathoms, coral, sand, station 6074; off Vieques, 12 to 16 fathoms, coral, stations 6091, 6092, 6093; off Humaçao, 9½ to 12½ fathoms, stations 6097, 6098, 6099. Previously collected at Orange Bluff, Clearwater Harbor, Florida, 1 to 2 fathoms (H. Hemphill, coll.); Marco, Fla. (H. Hemphill and U. S. Fish Commission); St. Thomas (*Albatross*); Gulf of Paria, 31 fathoms (Smith, type locality).

Parapenæus megalops Smith.

Parapenæus megalops Smith, Proc. U. S. Nat. Mus., VII, 172, 1885.

Surface of carapace and pleon naked and smooth. Median carina extending only half-way back on carapace; gastric spine remote from rostral teeth. Rostrum elevated, arched, terminal half very slender; armed with from twelve to fifteen dorsal spiniform teeth crowded posteriorly, but becoming more and more remote and smaller near tip; rostrum reaching to tips of antennal scales in females, shorter in males. Antennal, hepatic, and branchiostegal spines well developed. No antennal suture. Eyes extremely large, extending laterally beyond carapace. Antennal peduncles extending not so far beyond eyes as length of eyes; terminal segment longer than penultimate. Median carina of fourth to sixth segments of pleon thin and sharp; telson with a lateral as well as two dorsal carinæ.

Dimensions of female: Length from tip of rostrum to tip of telson, 140 mm.; length of carapace, including rostrum, 54 mm.; length of rostrum, 25 mm.

Taken in Mayaguez Harbor in 220 to 225 fathoms on rocky bottom, station 6070. Off South Carolina, 159 fathoms, station 2314 (*Albatross*); off Habana, 213 fathoms, station 2350 (*Albatross*); Gulf of Mexico, 196 fathoms, station 2399 (*Albatross*); off St. Kitts, 208 and 250 fathoms, *Blake* stations 147 and 148 (Faxon); off Grenada, 159 fathoms, *Blake* station 258 (Faxon); off Barbados, 218 to 288 fathoms, *Blake* stations 275, 281, and 283 (Faxon); south of Curaçao, 208 fathoms, *Albatross* station 2125 (Smith); Gulf of Darien, 155 fathoms, *Albatross* station 2143 (Smith).

Parapenæus americanus, sp. nov. Plate 2.

The carapace shows the fissures characteristic of *P. fissurus* (Bate)[1] and *P. investigatoris*, Anderson,[2] namely, a linear longitudinal fissure on either side running from the orbit to the posterior margin, and a short transverse fissure crossing branchial margin just above the second pair of feet. Our species is so closely allied to *P. investigatoris* that it may prove to be a subspecies of it. It differs as follows: Branchiostegal spine on anterior margin instead of behind it. The rostrum reaches just to end of first joint of antennulary peduncle and in small specimens falls short of it. The rostrum slopes upward at a greater angle than in *P. investigatoris* for its proximal two-thirds; distal third horizontal, not deflexed. Sixth abdominal segment only a little more than twice the fifth in length. Inner branch of antennulary flagellum only three-fourths the length of carapace, exclusive of rostrum.

This species is in some respects intermediate between *P. investigatoris* and *P. fissurus*; as in the length and breadth of the sixth abdominal segment and in the length of the antennulary flagella. The position of the branchiostegal spine is as in *P. fissurus*.

Dimensions of female: Length, 68.5 mm.; length of carapace, including rostrum, 22 mm.

The type specimens, a female and 3 smaller imperfect females, were taken in the trawl in Mayaguez Harbor, 220 to 225 fathoms, rocky, station 6070 (Cat. No. 23783).

Genus XIPHOPENEUS Smith.

Xiphopeneus Smith, Trans. Conn. Acad. Sci., II, 27, 1869.

Fourth and fifth pereiopods very long, the propodi multiarticulate and flagelliform. Mandibular palpus two-jointed, the distal segment much larger than proximal. Endognath of first maxilla short and unsegmented. Fourteenth somite without branchiæ. Antennular flagella longer than carapace.

Xiphopeneus kroyeri (Heller).

Penæus kroyeri Heller, Sitz. Ber. Acad. Wiss. Wien, XLV, 1 Abth., 425, pl. II, f. 51, 1862.
Xiphopeneus harttii Smith, Trans. Conn. Acad. Sci., II, 28, pl. I, f. 1, 1869.
Xiphopeneus kroyeri Smith, Proc. U. S. Nat. Mus., VIII, 188, 1885.

Cervical and branchio-cardiac sulci very distinct, together forming a nearly straight groove from near base of antennæ almost to posterior border. Rostrum very long and slender, equaling or exceeding

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[1] *Challenger* Rept., Zool., XXIV, 265, pl. XXXVI, f. 1, 1888.

[2] Ann. Mag. Nat. Hist. (7) III, 279, 1899; Illus. Zool. *Investigator*, Crustacea, part VII, pl. XLI, figs. 1, 1a, 1b.

carapace, unarmed below, basal portion armed above with a thin and high carina which extends back upon the carapace for a short distance, forward as far as the eyes, and armed with five sharp and prominent teeth and at its posterior extremity with another tooth separated by a considerable space. Antennæ long and slender; peduncle with only a very small lamelliform appendage on the inside, which is not foliaceous; flagella very long and slender. Fourth and fifth pairs of thoracic legs very long, the terminal segments very slender and flagelliform.

Length, about 5 inches.

Mayaguez and Arroyo, Porto Rico; plentiful. Caravellas, Province of Bahia, Brazil (Smith); Rio de Janeiro (Heller); Abrolhos (Kingsley); Maceio, State of Alagôas, Brazil (Branner-Agassiz Exped., 1899).

Genus SICYONIA Milne Edwards.

Sicyonia Milne Edwards, Ann. Sci. Nat., XIX, 344, 1830.

Integument rigid. Carapace surmounted by a median dentate crest. Abdomen carinated above and having several furrows which give it the appearance of being sculptured. Trunk-legs without exopods. Pleopods all single branched.

Key to the Porto Rican species of the genus Sicyonia.

A. Dorsal crest with three teeth on carapace and two on rostrum............*lævigata*
A'. Dorsal crest with two teeth on carapace and three on rostrum............*dorsalis*

Sicyonia lævigata Stimpson.

Sicyonia lævigata Stimpson, Ann. Lyc. Nat. Hist. N. Y., X, 131, 1871.

Carapace with three dorsal equidistant teeth. Rostrum long, reaching nearly to end of antennular peduncle; upper margin concave, with two teeth above; extremity upturned, truncate, with two or three spiniform teeth. Antennular peduncle long. External maxillipeds considerably longer than antennal peduncle. Third pair of feet exceeding the external maxillipeds by length of fingers and half the palm. Abdomen with sharp median carina; sides almost smooth, with shallow sulci.

Length of female from tip of rostrum to tip of telson, 40 mm.; length of carapace and rostrum, 16.2 mm.; length of rostrum, 6.8 mm.

The Porto Rican specimens are all smaller than the specimen measured. A few of them have six dorsal teeth instead of five, either four on the carapace proper or three on the rostrum.

Charleston, S. C. (Stimpson); Marco,* Fla., 1 to 3 fathoms (H. Hemphill, coll.); Punta Rassa, 1 fathom (H. Hemphill, coll.); Charlotte Harbor (W. H. Dall, coll.); Sarasota Bay (H. Hemphill, coll.; also recorded by Kingsley); off St. Martin's Reef, 17 feet (J. F. Moser, coll.); St. Thomas (*Albatross*); Sabanilla, United States of Colombia (*Albatross*). Porto Rico: Mayaguez, on coral reef; Mayaguez Harbor; off Vieques, 6 to 16 fathoms, stations 6085, 6092, and 6096; off Culebra, 15 and 15¼ fathoms, stations 6087 and 6093; off Humacao, 9½ and 12½ fathoms, stations 6098 and 6099.

Sicyonia dorsalis Kingsley.

Sicyonia dorsalis Kingsley, Proc. Acad. Nat. Sci. Phila., XXX, 1878, 97 (9).

Carapace with a tooth a little behind the middle and another near rostrum. Rostrum short, reaching slightly beyond eyes, extremity depressed; upper margin arcuate or convex, armed with three teeth above and one below near tip. Antennular peduncle short, the third joint half as long as second. External maxillipeds shorter than peduncle of antennæ. Third pair of feet reaching slightly beyond external maxillipeds. Abdomen deeply carinated and punctate, lateral margins of segments truncate, anteriorly angular, or with a small tooth, the third, fourth and fifth segments in the full-grown individual with a postero-lateral spine.

Dimensions of female: Length from tip of rostrum to tip of telson, 90 mm.; length of carapace and rostrum, 21.5 mm.; length of rostrum, 4.8 mm.

Porto Rican specimens are much smaller than the above.

Pensacola, Fla. (S. Stearns, coll.); Gulf of Mexico, 30 to 88 fathoms, stations 2403 to 2405 (*Albatross*); Fort Jefferson, Fla. (type locality); off Key West, 45 fathoms, station 2318 (*Albatross*); off Carysfort, 60 fathoms, station 2641 (*Albatross*); Straits of Florida, 56 fathoms, station 2639 (*Albatross*); off Habana, 230 fathoms, station 2321 (*Albatross*); Sabanilla, United States of Colombia (*Albatross*); Bermudas, (Verrill). Porto Rico: Mayaguez Harbor, 12 to 18 fathoms, station 6061; off St. Thomas, 20 to 23 fathoms, station 6079; off Vieques, 6 to 16 fathoms, stations 6091, 6092, and 6096.

Tribe CARIDEA.

Body generally laterally compressed. Antennules with a three-jointed peduncle, usually furnished with an external basal spine and two or three flagella. Antennal scale generally well developed. External maxillipeds generally pediform. One or both of the first two pairs of feet may be chelate, the three posterior pairs always simple. Abdomen long, the sides produced downward. Gills phyllobranchiate.

Family LYSMATIDÆ (Kingsley, 1878, Lysmatinæ).

NIKIDÆ Bate, 1888.

Rostrum horizontal with the dorsal surface of the carapace; mandibles without a cutting edge and without palp; first pair of trunk-legs more or less chelate, and stronger than the second, but not so long; second minutely chelate, with carpus subdivided.

Genus PROCESSA Leach.

Processa Leach, Mal. Podoph. Brit., text to pl. XLI, July 1, 1815.
Nika Risso, Hist. Nat. Crust. Nice, 84, 1816.

Rostrum short. Antennulæ biflagellate. Of the flagella of the antennulæ, one is long, the other short. One of the trunk-legs of the first pair chelate, the other simple. Carpus of second pair elongate, multiarticulate.

Processa canaliculata Leach.

Processa canaliculata Leach, Mal. Podoph. Brit., pl. XLI, and corresponding text, July 1, 1815.
Nika edulis Risso, Hist. Nat. Crust. Nice, 85, pl. III, f. 3, 1816.
Nika bermudensis Rankin, Ann. N. Y. Acad. Sci., XII, 536, pl. XVII, f. 2, 1900.

Carapace smooth. Rostrum slender, about half as long as eye-stalks, unarmed except at apex, which is obscurely bifid and furnished with a few long hairs. On the anterior margin of the carapace a spine below the eye. Antennal scale as long as antennular peduncle. Antennal peduncle reaching about to the end of second joint of antennular peduncle. First pair of feet rather stout, reaching a little beyond antennal scale. Right or chelate foot with the palm a little longer than carpus or fingers. Left foot of first pair with dactylus about one-fourth the length of propodus. Remaining feet slender and long. Second pair unequal in length. Meral joints of third and fourth pairs armed beneath with sharp, slender spinules. American specimens have the legs more slender than in the European specimens with which I have compared them. They resemble in that respect the variety of *N. edulis*, which Bell named *N. couchii*.

Europe; Madeira (Stimpson); Japan (Ortmann); off North Carolina, 32 and 25 fathoms, stations 2605 and 2606 (*Albatross*); Marco, Fla., 1 to 3 fathoms (H. Hemphill, coll.); Key West, Fla. (H. Hemphill, coll.); west coast of Florida, 17 and 45 fathoms, stations 5066 and 5119 (*Grampus*); Gulf of Mexico, off Cape San Blas, Fla., 25 and 111 fathoms, stations 2370, 2373, and 2402 (*Albatross*); Old Providence, West Indies (*Albatross*); Bermudas (G. Brown Goode, coll.), also recorded by Rankin. Porto Rico: Boqueron Bay; off Vieques, 12½ fathoms, station 6095.

Family ALPHEIDÆ Milne Edwards, 1837 (Alphéens); Kingsley, 1878 (Alpheinæ); Bate, 1888.

Rostrum minute or of moderate size; eye-stalks short and usually more or less covered by the projection of the frontal margin of the carapace; mandibles with a cutting edge distinct from the molar process and a one or two jointed palp; first pair of trunk-legs robustly chelate, often unsymmetrical, the second pair long and slender, minutely chelate, with carpus subdivided.

Key to the Porto Rican genera of the family Alpheidæ.

A. Eyes covered by carapace.
  B. Carapace not cristate.
    C. Thoracic feet with epipods. Propodus of large cheliped compressed .... *Alpheus*
    C′. Thoracic feet without epipods. Propodus of large cheliped cylindrical .... *Synalpheus*
  B′. Carapace cristate .... *Jousseaumea*
A′. Eyes with stalks projecting well in advance of carapace .... *Automate*

Genus ALPHEUS Fabricius. Coutière.

Alpheus Fabricius, Suppl. Entom. Syst., 380, 1798; Coutière, Ann. Sci. Nat. (8), Zool., IX, 336, 1899.

Carapace smooth. Rostrum of variable shape. Orbital arches usually very complete, isolated by an orbito-rostral depression and an orbito-antennal sulcus; formed by excessive development of extra-corneal spines, of which the point frequently remains. No pterygostomian spine. Antennules with basal article and spine reduced. Distal article of third maxillipeds drawn out to a point and almost unarmed. Thoracic feet with epipods. First pair with an asymmetry usually very marked. Carpus very short, hemispherical. Chelæ depressed, of variable form. Third to fifth pairs of feet with propodi strongly spinulous; dactyli usually simple, sometimes lanceolate.

Key to the Porto Rican species of the genus Alpheus.

A. Carapace without median spine at base of rostrum. No long spine between rostrum and eyes.
  B. Orbit with a small spine on the margin.
    C. Propodus of large cheliped notched on both margins.
      D. Basal antennal spine very short, not reaching second segment of antennula. Antennal scale no longer than antennular peduncle..... .... *macrocheles*
      D'. Basal antennal spine reaching second segment of antennula. Antennal scale longer than antennular peduncle .... *dentipes*
    C'. Propodus of large cheliped not notched on margins .... *formosus*
  B'. Orbit without a spine.
    C. No basal antennal spine .... *cristulifrons*
    C'. A basal antennal spine.
      D. Orbital margin forming a projecting tooth. Both surfaces of large hand with a longitudinal groove, between these grooves a tooth.......... *packardii*
      D'. Orbital margin simply rounded, without a tooth.
        E. Hands of large cheliped notched on both margins.......... *heterochælis*
        E'. Hands not notched on the margins.
          F. Hand with two longitudinal grooves on outer surface .... *rostratipes*
          F'. Hand with one groove on either surface leading from pollex.......... *floridanus*
A'. Carapace with a median spine at base of rostrum. A long spine between rostrum and eyes. .... *armatus*

Alpheus macrocheles (Hailstone).

Hippolyte macrocheles Hailstone, Mag. Nat. Hist., VIII, pp. 395, 519, 552, 553, 1835.
Alpheus megacheles Norman, Ann. Mag. Nat. Hist. (4), II, 175, 1868.

Rostrum a short, acute spine, much shorter than first antennular segment. Orbital margin with a smaller spine, less advanced than rostrum. Third antennular segment half as long as second. Basal scale broad, triangular, tipped with a spine reaching nearly to second segment. Antennal peduncle longer than antennular. Scale equal or nearly equal to antennular peduncle. Basal spine very short, shorter than antennular scale. Propodus of large cheliped much compressed, with upper and lower margins notched. Distal portion of outer face with three longitudinal furrows; the crest between middle and lower furrows prolonged into a spine between bases of fingers. Superior margin of dactylus with a thin, sharp edge. Smaller cheliped also broad; propodus with both margins notched, upper notch very feeble; outer face marked with shallow grooves, and a spine at base of fingers, similar to those in the large cheliped, but less strong. The carpal joints of the second pair diminish as follows: First, second, fifth, fourth, third; the first or proximal joint being the longest.

Length of European specimen, 24.8 mm.

A large chela of a small specimen of this east Atlantic species was taken in Mayaguez Harbor, 161 to 172 fathoms, station 6066. In this claw the distal extremity of the upper margin is spiniform instead of lobiform as in the large European specimens that I have at hand; the superior furrow of the outer face is longer, extending two-thirds the length of the palm. The marginal notches are slight. It is possible that this claw belongs to a distinct species.

A. macrocheles is known from Europe and West Africa.

Alpheus dentipes Guérin.

Alpheus dentipes Guérin, Exp. Scient. Morée, part. Zool., 39, pl. XXVII, f. 3, 1832.
Alpheus candei Guérin, in La Sagra's Hist. Cuba, 2d part, VII, p. XIX, pl. II, f. 9, 1857.
Alpheus transverso-dactylus Kingsley, Bull. U. S. Geol. Survey, IV, 196, 1878.

Rostrum a slender spine, not reaching second antennular segment. Orbital margin with a small spine, less advanced than rostrum; on the margin between rostrum and orbital spine a thin laminate lobe. Third segment of antennular peduncle half as long as second. Basal scale short and broad, tipped with a spine, and falling far short of second segment. Antennal peduncle longer than antennular, its scale intermediate in length between the two peduncles; spine of scale long, projecting well beyond blade. Basal spine reaching line of anterior margin of first antennular segment. Propodus of large cheliped with upper and lower margins notched. Distal portion of outer face with three longitudinal furrows; crest between middle and lower furrows terminates in a spine between bases of fingers, as in *A. macrocheles;* upper furrow continued posterior to notch by an oblique furrow passing over on to inner face. Superior margin of dactylus somewhat thickened and rounded. Smaller cheliped similar to that of *macrocheles*, but the margins of propodus are deeply notched and the superior groove of the outer face is oblique and continued on inner face, as in the large cheliped. Small chela of female much more slender and with longer fingers than in male. Carpal joints of second pair diminish as follows: First, second, fifth, fourth, third.

Length of European specimen, 25.3 mm.; Porto Rican specimens all very small.

Mediterranean; Cape Verde Islands (Stimpson, as *A. streptochirus*); Bermudas, G. B. Goode (Kingsley); Cuba (Guérin); Key West (Kingsley); Santa Barbara and San Diego (Kingsley). Porto Rico: Puerto Real; Playa de Ponce; Arroyo; Ensenada Honda, Culebra.

Alpheus formosus Gibbes.

Alpheus formosus Gibbes, Proc. Amer. Assoc. Adv. Sci., III, 196, (32), 1850.
Alpheus poeyi Guérin, in La Sagra's Hist. Cuba, 2d part, vol. VII, p. XIX, pl. II, f. 10, 1857.

Rostrum flat, narrow-triangular, beginning at posterior line of the eyes, long-pointed and reaching or nearly reaching second antennular segment. Orbits with a slender spine, much shorter than rostrum. Antennular scale overreaching first segment; second segment a little longer than third. Antennal peduncle longer than antennular; scale a little longer than peduncle. Basal spine reaching only to second antennular segment. Hand of larger cheliped compressed, without notches or grooves. Dactylus about two-fifths the length of palm, moving horizontally. Hand of small cheliped very slender; fingers as long as palm; a spine on inner face of palm, at base of the dactylus. The carpal joints of the second pair diminish as follows: First, fifth, second, third, fourth; the first joint twice the length of second.

Length of ovigerous female, 17.3 mm.

Porto Rico: Mayaguez; Mayaguez Harbor, 4 to 6 fathoms, station 6065; Playa de Ponce; off Humaçao, 9½ fathoms, station 6099; Ensenada Honda, Culebra; Fajardo. Key West (Gibbes); Cuba (Guérin); Bermudas (G. Brown Goode, coll.; also recorded by Verrill); Natal to Maceio, Brazil (Branner-Agassiz Exped., 1899).

Alpheus cristulifrons Rathbun.

Alpheus obeso-manus Pocock, Jour. Linn. Soc. London, Zool., XX, 520, 1890 (nec Dana).
Alpheus cristulifrons Rathbun, Proc. Washington Acad. Sci., II, 152, 1900.

On the median line between the eyes is a thin sharp crest, terminating in front in a short upturned rostral tooth, only slightly advanced beyond the orbital hoods, which have rounded margins without spines. Second segment of antennular peduncle nearly twice as long as third. Scale very short, not reaching second segment. Antennal scale a little longer than antennular peduncle and a little shorter than antennal peduncle; its thickened outer portion very wide, terminating in a spine, extending considerably beyond the thin inner blade. No basal spine. Propodus of large cheliped almost cylindrical, very slightly compressed, in general appearance smooth. A faint notch on upper margin near dactylus. On the outer side a shallow longitudinal groove across the pollex, which is continued a short distance on palm. Dactylus a little less than half the length of upper margin of palm and moves horizontally. Smaller hand somewhat resembles the larger, except that it is less twisted, less cylindrical, with dactylus and thumb straighter and relatively longer. The carpal joints of second pair diminish as follows: Second, fifth and first, fourth and third; the second being as long as the third, fourth, and fifth together.

Length of an ovigerous female, 16.7 mm.

Porto Rico: Playa de Ponce; Arroyo, on Light-house Reef; Ensenada Honda, Culebra. Fernando Noronha (Pocock); Maceio, Brazil (Branner-Agassiz Exped., 1899).

Alpheus floridanus Kingsley.

Alpheus floridanus Kingsley, Bull. U. S. Geol. Survey, IV, 193, 1878.

Rostrum a sharp spine falling far short of the second antennular segment. Orbital margin rounded, without a spine. Second antennular segment very long, more than twice as long as third. Scale very short, its spiniform tip reaching half-way between rostrum and second segment. Antennal scale a little longer than antennular peduncle; antennal peduncle considerably longer. Basal spine very short, less advanced than rostrum. Propodus of chelipeds elongate and much compressed; margins entire; inner and outer surfaces in large cheliped with a broad, shallow groove leading from pollex; surface granulate; dactylus nearly as long as upper margin of palm. Propodus of smaller cheliped much more slender, fingers considerably longer than palm. Carpal joints of second pair diminish as follows: Second, first, fifth and fourth, and third; second nearly as long as third, fourth, and fifth taken together.

Length of Porto Rican specimen, 41.5 mm.

Porto Rico: Mayaguez Harbor, 7 to 18 fathoms, stations 6059 and 6061; Puerto Real; off Puerto Real, 8½ fathoms, station 6074; off Boca Prieta, 8½ fathoms, station 6075; off Humaçao, 9½ fathoms, station 6099; Fajardo. Fort Jefferson, Fla. (Kingsley).

Alpheus heterochælis Say.

Alpheus heterochælis Say, Jour. Acad. Nat. Sci. Phila., I, 243, 1818.
Alpheus heterochelis Herrick, Mem. Nat. Acad. Sci., V, 372, pl. II (colored), 1891.

Rostrum carinated, slender, either reaching or nearly reaching to end of first antennular segment. Orbital margin rounded, without a spine. Second antennular segment twice as long as third; scale with a slender terminal spine reaching end of first segment. Antennal peduncle as long as or longer than antennular; scale longer than antennular peduncle; basal spine very short, reaching only slightly beyond orbital margin. Chelipeds very unequal. Propodus of larger cheliped much distorted and deeply and irregularly grooved; outer and inner margins with a deep notch near fingers. Dactylus more than half as long as palm, its distal margin almost at right angles to outer. Smaller cheliped very slender, palm slightly notched; fingers proportionally longer than in large cheliped. Carpal joints of second pair diminish as follows: First, second, fifth, third, fourth; the first being equal to the sum of the last three.

Length of Porto Rican specimen, 27.7 mm.

Porto Rico: Mayaguez; Boqueron Bay; Arroyo; off Vieques Island, 16 fathoms, station 6092; Hucares; Ensenada Honda, Culebra. The specimens from Mayaguez, Hucares, and station 6092 have the rostrum more flattened at the base, as in Rankin's *A. lancirostris;* whether this last has specific value I am unable to determine.

North Carolina to Rio de Janeiro (Kingsley); Bermudas (G. Brown Goode, coll.); Lower California (Lockington); west coast of Nicaragua and Panama (Kingsley); Mamanguape to Maceio, Brazil (Branner-Agassiz Exped., 1899).

Alpheus packardii Kingsley.

Alpheus packardii Kingsley, Proc. Acad. Nat. Sci. Phila., XXXI, 417, for 1879 (1880).
Alpheus bermudensis Bate, *Challenger* Rept., Zool., XXIV, 547, pl. XCVIII, f. 3, 1888.
Alpheus minus Herrick, Mem. Nat. Acad. Sci., V, 372, pl. I (colored), 1891 (nec Say).

Rostrum carinated, carina extending behind eyes; extremity spiniform reaching nearly to second antennular segment. Margin of orbit projecting as a blunt tooth. Second antennular segment nearly twice as long as third; scale about as advanced as rostrum. Antennal peduncle and scale subequal, slightly longer than antennular peduncle. Propodus of chelipeds greatly compressed; a triangular, longitudinal groove on both upper and lower surfaces near outer margin; the margin between these grooves forms a tooth near distal end of palm; between this tooth and the dactylus is a notch in the margin; inner margin with shallow sinus. Smaller propodus half as wide as larger and similarly formed; a sharp spine on distal end of outer margin of upper surface. Carpal joints of second pair, diminish as follows: Second, first, fifth, third, and fourth; the second being very slightly greater than first.

Length of Bermudan specimen, 24.5 mm.

Porto Rico: Mayaguez; Boqueron Bay; Playa de Ponce; Arroyo; off Vieques, 6 to 16 fathoms, stations 6085, 6091, 6092, 6095, 6096; off Culebra, 14¾ to 15 fathoms, stations 6086, 6093; Ensenada Honda, Culebra; Fajardo.

Beaufort, N. C. (Herrick); Key West (Kingsley); St. Thomas (Bate); Bermudas (Bate and U. S. Nat. Mus.).

Alpheus rostratipes Pocock.

Alpheus rostratipes Pocock, Jour. Linn. Soc. London, Zool., xx, 522, 1890.

Carapace cristate between eyes; rostrum spiniform, not reaching second antennular segment. Margin of orbits rounded. Segments of antennular peduncle subequal in length; spine of scale reaching to middle of second segment. Antennal scale equal in length to antennular peduncle; scale with a very broad blade, much shorter than its spine. Antennal peduncle a little longer than antennular; basal spine about as advanced as antennular scale. Merus of large cheliped with a sharp tooth at distal end of superior margin. Propodus compressed, subovate, much higher than fingers; slightly twisted; distal half of outer face with two longitudinal grooves which converge toward thumb; upper margin with a shallow groove. Thumb extremely short; dactylus less than one-third the length of palm. Fingers of smaller cheliped longer than palm. Thumb twice as wide at base as dactylus. Carpal joints of second pair becoming progressively shorter in the following order: First, fifth, second, third, fourth.

A small species, a female with eggs measuring 10.5 mm. in length.

Arroyo, Porto Rico. Type locality, Fernando Noronha (Pocock).

Alpheus armatus, sp. nov.

Carapace of female compressed, high, the height being equal to length exclusive of rostrum; smooth. Rostrum extending nearly to the second segment of peduncle of antennulæ; narrow, tip acuminate; depressed, upper surface concave from behind forward, lateral margins fringed with bristles; a short blunt median spine at base on a line with bases of eye-stalks; rostrum separated from eye-stalks by a deep groove. Between the base of rostrum and inner base of eye-stalk on each side is a long spine with slender tip; tips convergent, rising a little above level of adjacent part of rostrum and not reaching extremity of eyes. Although the eye-stalks are plainly visible, they are entirely covered by an extension of carapace; cornea large and dark-colored, obtusely pointed in front. Anterior margin of carapace external to the eyes entire. The spine of antennular scale is slender and extends about as far forward as the rostrum. Second joint of peduncle about twice as long as third joint. Outer branch of flagellum thick except at extremity, and a little longer than peduncle; inner branch slender and three times as long as outer. The antennal scale nearly as long as antennular peduncle. It is rounded at the end and has a slender spine separated from the blade by a narrow slit extending half the length of the scale; a short spine at its outer inferior base. Peduncle a little longer than that of antennula; flagellum longer than body. The external maxillipeds reach, when extended, as far as end of antennular peduncle; they are clothed with long hairs.

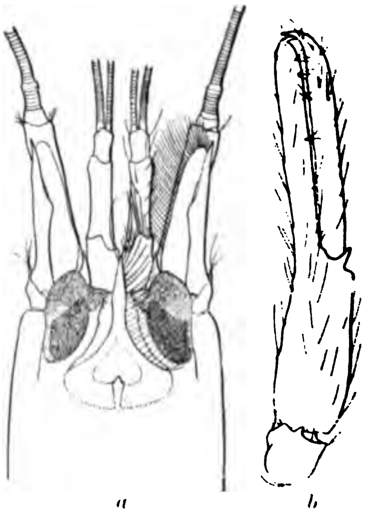

FIG. 20.—*Alpheus armatus*, female. (*a*) Anterior portion, × 4. (*b*) Small cheliped, × 4.

First pair of feet missing in type specimen; second pair slender (right one present) and as long as outer antennular flagellum; ischium and merus subequal; first joint of carpus about two-thirds as long as merus; second joint half as long as first, a trifle longer than fifth, and twice as long as third or fourth, which are subequal. Digits about equal to palm and also to last carpal joint. The third foot reaches about to last carpal joint of second pair. Merus three times as long as ischium and twice as long as carpus; it has an inferior distal spine. Propodus somewhat shorter than merus, its inferior margin bordered by nine long slender spines. Dactylus short, about one-fourth propodus, curved, with a slender nail. Fourth and fifth pairs of feet similar to third, but slenderer and shorter; in the fifth pair there are but six propodal spines.

Abdomen smooth and rather short and thick. The telson has two pairs of spines on its dorsal face; extremity slightly arcuate, with a spine on either side. Lateral laminæ subequal in length and longer than telson; inner branch suboval and unarmed; outer branch with an irregular transverse suture and a long black spine near outer terminal angle. Basal scale of uropods two-spined.

Dimensions of female: Length of body from tip of rostrum to tip of telson, 25 mm.; length of carapace, 9.3 mm.; length of carapace to the median spine at base of rostrum, 6.3 mm.; height of carapace, 7 mm.; width of carapace, 5.5 mm.; length of second pair of feet, 18 mm.

Type locality, Ponce, 1 female (Cat. No. 23784).

This species approaches *A. intrinsecus* Bate, but differs from it and from all other species of the genus in having a median dorsal spine at base of rostrum. A specimen of *A. armatus*, an ovigerous female, larger than the type, was taken in Kingston Harbor, Jamaica, by Dr. J. E. Duerden. The rostro-orbital spine is shorter than in the type, not reaching beyond middle of cornea. The rostrum and antennular scales are equally advanced. Antennal flagellum is 1.5 times the length of body.

The large cheliped is missing, as in the type. The small cheliped has a merus about three times as long as broad, inner margins spinulous, outer margin terminating in a small spine. Carpus short, subspherical, its distal margin on the outer side with a prominent tooth. Palm nearly as long as merus, subcylindrical, narrowing a little distally, somewhat angular, its upper surface with two marginal lines; surface clothed with long hairs which arise from scabrous granules or spinules; palm with a sharp spine on outer and another on inner side of its distal margin. Fingers longer than palm, cylindrical, of equal size, bent downward, tips strongly curved, sharp, crossing each other; prehensile margins very finely denticulate and closing tightly together. Length of carapace, 13.6 mm.

Genus SYNALPHEUS Bate. Coutière.

Synalpheus Bate, Challenger Rept., Zool., XXIV, 572, 1888. Coutière, Ann. Sci. Nat. (8), Zool., IX, 334, 1899.

Carapace smooth. Front tridentate or trispinous, the orbital arches being formed by the well-developed extra-corneal spines, completed frequently by a vertical prolongation from base of rostrum. A pterygostomian spine present. Antennules with basal article the longest; basal spine wide, equal to sum of two first articles. Distal article of third maxillipeds elongate, armed with strong spinules at tip. Thoracic feet without epipods. First pair very asymmetrical. Large cheliped with carpus very short; propodus ovoid, smooth, entire; movable finger very short. Small cheliped with the carpus frequently elongate and cylindrical, palm entire and smooth, fingers exactly joining. In Porto Rican specimens the carpus of the second pair has the first joint twice or more than twice the fifth, and the second, third, and fourth joints very small and subequal. Third to fifth pairs with propodi feebly spinulous; dactyli always bifid, sometimes triunguiculate.

Key to the Porto Rican species and subspecies of the genus Synalpheus.

A. Antennular scale overreaching first antennular segment.
  B. Dactylus of larger cheliped less than half the length of palm.......................... *minus*
  B′. Dactylus of larger cheliped at least half as long as palm.......................... *neptunus*
A′. Antennular scale not reaching beyond first antennular segment.
  B. Basal antennal spine elongate, surpassing the spine of scale.......................... *lævimanus pococki*
  B′. Basal antennal spine shorter than the spine of scale, but still surpassing the first antennular segment.
lævimanus longicarpus

Synalpheus minus (Say).

Alpheus minus Say, Jour. Acad. Nat. Sci. Phila., I, 245, 1818.
Alpheus tridentulatus Dana, Crust. U. S. Expl. Exped., I, 552, 1852; pl. XXXV, f. 4, 1855.
Alpheus saulcyi Guérin, in La Sagra's Hist. Cuba, 2d part, vol. VII, p. XVIII, pl. II, f. 8, 1857.
Alpheus pœcox Herrick, Johns Hopkins Univ. Circ., VII, No. 63, p. 37, 1888.
Alpheus saulcyi var. *brevicarpus* Herrick, Mem. Nat. Acad. Sci., V, 381, pl. IV (colored), 1891.
Synalpheus minus Coutière, Bull. Soc. Entom. France, 1898, No. 8, 190, fig. 4.

Rostral and orbital spines present, the rostral reaching to middle of first antennular segment and a little longer than orbital. Antennular scale reaching to about middle of second segment. Antennal scale as long as antennular peduncle, shorter than antennal peduncle. Basal spine reaching to end of antennular segment. Dactylus of large cheliped less than half the length of palm. Carpus of small first cheliped very short, hemispherical.

Length of Porto Rican specimen, 11.5 mm.

Taken by the Porto Rican expedition at Mayaguez Harbor, 4 to 6 fathoms, station 6065; Mayaguez, on coral reef; Puerto Real; Playa de Ponce; Arroyo; off Vieques, 15 to 16 fathoms, stations 6091, 6092;

off Humaçao, 9½ fathoms, station 6099; off Culebra, 15 to 15¼ fathoms, stations 6087, 6093; Ensenada Honda, Culebra; off St. Thomas, 20 to 23 fathoms, stations 6079, 6080.

Beaufort, N. C. (Kingsley), to Rio de Janeiro? (Dana); Bermudas (Kingsley); Panama (Kingsley). In green sponges (Herrick); Maceio, Brazil (Branner-Agassiz Exped., 1899).

Synalpheus lævimanus longicarpus (Herrick).

Alpheus saulcyi var. *longicarpus* Herrick, Mem. Nat. Acad. Sci., v. 383, 1891.
Synalpheus lævimanus var. *longicarpus* Coutière, Bull. Soc. Entom. France, 1898, No. 8, 189, fig. 2.

Rostral and orbital spines similar to those of *S. minus*. Antennular scale not reaching quite to end of first segment. The antennal scale is variable in length and may reach the middle of second antennular segment or to end of third segment. Basal spine of antenna overreaching first antennular segment. The dactylus of the larger cheliped is relatively longer than that of *S. minus*; it is still less than half the length of palm; palm narrower than in that species. Carpus of small cheliped elongate, of variable length, either cup-shaped or subcylindrical.

Length of Bermudan specimen, 15.8 mm. Porto Rican specimens much smaller.

Porto Rico: Mayaguez Harbor, 22 to 33 fathoms, station 6064; off Vieques, 12½ fathoms, station 6095; off St. Thomas, 20 fathoms, station 6080.

Florida Keys, Bahamas, and Antilles, in brown sponge, *Hircinia acuta*; Bermudas (G. Brown Goode and George Hawes, coll.).

Synalpheus lævimanus parfaiti Coutière.

Synalpheus lævimanus var. *parfaiti* Coutière, Bull. soc. Entom. France, 1898, No. 8, 191, fig. 3.

Rostral spine. Orbital margins forming blunt lobes almost as far advanced as rostrum. The antennular scale does not reach beyond first segment, but is equal or almost equal to it. The spine of the scaphocerite may be as long as or fall somewhat short of antennular peduncle; its scale is absent in type, but present in specimens before me as a very narrow strip, much shorter than the spine. Basal antennal spine as long as or longer than scaphocerite. The large cheliped in shape and proportions resembles that of *S. minus*; the palm has the strongly projecting distal tooth of *S. lævimanus longicarpus*. The carpus of small cheliped is somewhat longer than that of typical *lævimanus* figured by Coutière, *op. cit.*, fig. 1*b*.

Length of Porto Rican specimen, 14 mm.

Off Vieques, 14 fathoms, station 6085; off St. Thomas, 20 to 23 fathoms, station 6079. Type locality, Annobon, West Africa.

Synalpheus neptunus (Dana).

Alpheus neptunus Dana, Crust. U. S. Expl. Exped., I, 553, 1852; pl. 35, f. 5, 1855.
Synalpheus neptunus Coutière, Ann. Sci. Nat. (8), Zool., IX, 15, 1899.

In typical specimens, the front is three-spined, spines subequal. The antennular scale overreaches first antennular segment and extends from one-third to one-half the length of second segment. The antennal scale is longer than antennular peduncle, about as long as antennal peduncle. The basal spine is as long or nearly as long as antennular scale. Dactylus of large cheliped longer than in any other Porto Rican species; it is one-half or more than one-half the length of palm. Carpus of smaller cheliped short.

Specimens from the Bermudas have the rostral spine considerably longer than orbital, reaching one-half the length of basal segment. Dactyli of third, fourth, and fifth pairs of feet triunguiculate, the third nail being rudimentary. Length, 21.3 mm.

In the Porto Rican collection there is but one small specimen, dredged off Gallardo Bank, 10 fathoms, station 6076. This specimen varies considerably from typical ones. The frontal projections are dentiform, short, but still, in relation to the antennular peduncles, they are as advanced as in typical specimens. Antennular scale of normal length. Antennal scale scarcely attaining end of antennular peduncle. Basal spine reduced, not reaching end of first antennular segment. The large cheliped resembles closely that of Bermudan specimens.

Sooloo Sea, 6½ and 9 fathoms, and Fiji Islands (Dana); Red Sea (Heller, Paulson); Bermudas (G. Brown Goode, coll.).

Genus **JOUSSEAUMEA** Coutière.

Jousseaumea Coutière, Bull. Mus. Hist. Nat. Paris, II, 1896, 381.

Carapace depressed, more or less carinated; rostrum broad and flat. Eyes wholly or almost wholly concealed beneath carapace. First pair of feet asymmetrical; large cheliped with merus elongate; carpus short, cup-shaped; propodus with three or four surfaces; fingers saw-toothed.

Jousseaumea trigona, sp. nov.

I have placed this species (which is represented by a single specimen in bad condition) provisionally in *Jousseaumea*, although the chelipeds are not folded under the body and the propodus is three-sided.

Carapace of female with nine sharp longitudinal crests. The median extends from tip of rostrum to near posterior margin of carapace. The next crest extends from margin of orbital hoods about two-thirds the length of carapace; on the posterior third this crest is replaced by a curved crest, which anteriorly turns downward and outward, and then backward, forming a portion of an oval. The third crest begins on a line with lower margin of eye, and a little behind eye, and extends backward and slightly downward to posterior third of carapace; it there forms an obtuse angle and curves slightly upward and backward to near posterior margin. Fourth crest short, arising behind third, and extending barely half-way back on carapace. Fifth crest very short, extending obliquely downward from tip of antennal spine. The rostrum viewed from above is triangular, acute, the tip reaching slightly beyond first segment of antennula; anterior margin of carapace sloping obliquely backward in a sinuous line to lateral angle. Eyes large and entirely covered by carapace. Antennular peduncle short, the second segment a little longer than third. Its scale is as broad at base as peduncle and overreaches a little the penult segment of peduncle. Antennal peduncle a little longer than antennular. Its scale very broad, with almost straight outer margin and not quite so long as antennular peduncle; the distal spine scarcely overreaches the blade.

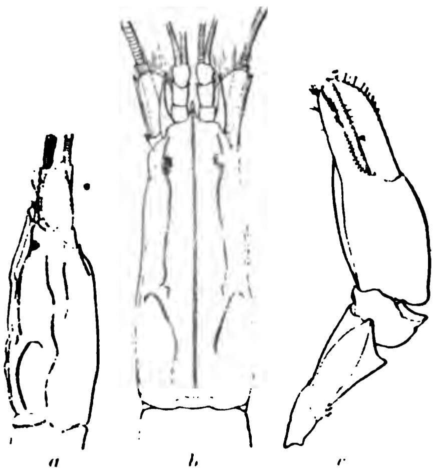

FIG. 21.—*Jousseaumea trigona*, female. (a) Side view of carapace and antennæ. × 6. (b) Dorsal view of carapace and antennæ. × 7.5 (c) Lower view of left cheliped. × 10.

The outer maxilliped reaches nearly to end of antennal peduncle; it is flattened, with sharp, lateral edges; terminal joint acuminate. The large cheliped extends beyond antennal peduncle by only about two-thirds the length of fingers. Merus triangulate, increasing in size distally; a sharp, longitudinal, and somewhat curved crest on its inner inferior margin. Carpus very short, with a sharp outer tooth. Palm triangulate, with a flat superior surface, a convex infero-outer face, and a narrower flat infero-inner face; three surfaces separated by sharp crests, of which the outer one has a curved tooth at proximal end. Fingers about as long as palm, subcylindrical, the movable or outer larger than immovable or inner; fingers terminating in short, slender horny tips crossing each other. Prehensile edges subentire and ciliate. Smaller cheliped missing. The palm of second pair of feet overreaches slightly the antennal peduncle The first segment of carpus is equal to second, third, and fourth taken together. These three are subequal. The fifth is 1.5 times the fourth. Palm as long as fifth carpal segment; fingers a little longer than palm. The third pair of feet reach to distal third of fingers of the large cheliped. They are slender. Carpus about half the length of the merus and two-thirds the propodus. Dactylus half as long as the propodus. Propodus with a few spinules on lower margin.

Length of female from tip of rostrum to tip of telson, 13.2 mm.; length of carapace, 5.5 mm.

Type locality, off Vieques, 6 fathoms, coral, station 6096, 1 female (Cat. No. 23785).

Genus AUTOMATE de Man.

Automate de Man, Arch. f. Natur., LIII, part I, 529, 1887.

Carapace compressed, leaving the eyes exposed by a large sinus; armed with a feeble median convexity. Eye-stalks parallel, conical, cornea much reduced. Antennular peduncles extremely elongate, especially the median article; flagellum simple; stylocerite very small. Antennal scale very short; carpal joint very elongate. Third maxillipeds very slender, much longer than antennulary peduncles. Anterior feet strong, asymmetrical, especially in the male, compressed, smooth, and entire. Carpus very short, globular. Movable finger of large chela with a molar process penetrating a cavity in the immovable finger. Second pair long; first carpal segment shorter than the second. Remaining feet robust, compressed, unarmed, dactylus simple.

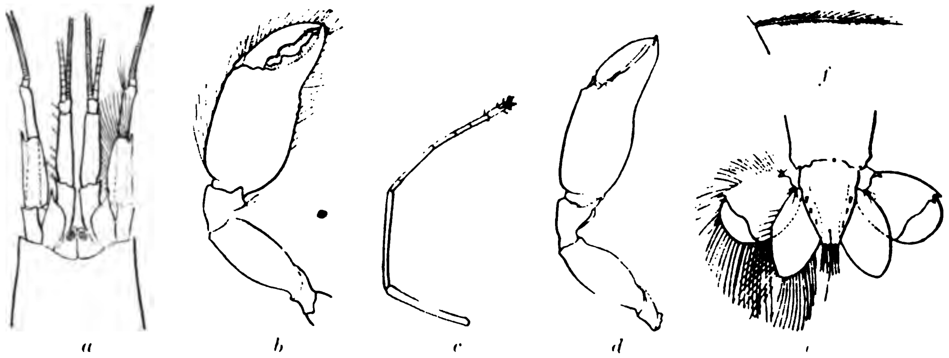

FIG. 22.—*Automate evermanni.* (*a*) Anterior portion, × 8. (*b*) Cheliped of male, × 8. (*c*) Second leg, × 8. (*d*) Cheliped of female, × 8. (*e*) Tail fan, × 10.66. (*f*) Hair from tail, much enlarged.

Automate evermanni, sp. nov.

This species in its carapace and eyes resembles *A. dolichognatha* de Man. The antennular scale is shorter than in *dolichognatha;* antennal scale longer than in that species, in adults reaching two-thirds the length of penult segment of antennular peduncle; its outer margin is straight. The outer maxillipeds reach beyond antennular peduncles by the entire length of terminal joint. The large cheliped of the male resembles that of *dolichognatha* figured by Coutière; the anterior margin of the carpus has a projecting tooth on lower part of outer side; another smaller tooth on upper part of inner side. Lower margin of propodus granulated near its middle. Fingers gaping. Pollex longer than in *dolichognatha*, and dactylus tapering more regularly toward the extremity than in that species. In the female the carpus is longer, the propodus narrower, non-granulate, the fingers do not gape. The smaller cheliped is lacking in all the specimens. In the carpus of second pair of legs the first joint is the shortest, being only between one-third and one-fourth the length of second joint. Third joint a little more than one-half the second, fourth joint a little longer than the first, fifth joint intermediate between the third and fourth. The seventh abdominal segment more tapering than in *dolichognatha;* it has two small spines on each side of its dorsal surface near lateral margin; they are near together and near the middle of the length of segment. The two terminal spines are longer than in the type species. Caudal laminæ broader and more oval than in *dolichognatha*.

Dimensions of male: Length from frontal margin of the carapace to tip of seventh abdominal segment, about 14.2 mm.; length of carapace, 4.4 mm.

Type locality, off Aguadilla, 137 fathoms, sand, mud, and shells, station 6055, 2 males, 1 female (Cat. No. 23786). Also taken at Mayaguez Harbor, 12 to 18 fathoms, station 6061.

The specific name is given in honor of Dr. B. W. Evermann, chief naturalist of the Fish Commission expedition to Porto Rico.

Family HIPPOLYTIDÆ Bate, 1888.

Rostrum of important size; eyes not covered by carapace; the mandibles may have a cutting edge and palp, or be without one or both; first pair of trunk-legs with moderate-sized chelæ; second pair chelate, with the wrist or fifth joint sometimes much and sometimes little subdivided.

Key to the Porto Rican genera of the family Hippolytidæ.

A. Carpus of second pair of feet composed of few segments.
  B. Rostrum large. Carpus of second pair of feet biarticulate or triarticulate.
    C. Carpus biarticulate. Rostrum suborbicular.......... *Platybema*
    C'. Carpus triarticulate.
      D. Rostrum cultriform.......... *Latreutes*
      D'. Rostrum very slender.......... *Tozeuma*
  B'. Rostrum very short. Carpus five-articulate.......... *Thor*
A'. Carpus of second pair of feet composed of many segments.......... *Hippolysmata*

Genus PLATYBEMA Bate.

Cyclorhynchus de Haan, Fauna Japon., 174, 1849. Name preoccupied.)
Rhynchocyclus Stimpson, Proc. Acad. Nat. Sci. Phila., XII, 27 (96), 1860. (Name preoccupied.)
Platybema Bate, Challenger Rept., Zool., XXIV, 576, 578, 1888.

Carapace dorsally carinated, produced anteriorly to a large, laterally compressed, deep rostrum, which projects below level of dorsal ridge. Pleon generally, but slightly, compressed laterally, having the lateral coxal plates largely developed. Eye-stalks short, stout. First pair of antennæ short, peduncle not reaching to end of scaphocerite; flagella two, short, extending but little beyond extremity of rostrum. Second pair of antennæ having a short and broad scale that narrows toward extremity, is armed with a small tooth on outer margin and fringed with long hairs on inner, and does not reach beyond extremity of rostrum; flagellum about one-half the length of the animal. Mandibles short, strong, cylindrical, without cutting edge or palp. Second maxillipeds six-jointed. First and second pairs of thoracic feet short; first pair robust, having the carpus short and anteriorly excavate to receive extremity of propodus, which articulates with it at the infero-distal angle; second pair slender, carpus biarticulate. Pleopoda biramose, foliaceous, unequal. Telson triangular.

Platybema rugosum Bate.

Platybema rugosus Bate, Challenger Rept., Zool., XXIV, 579, pl. CIV, f. 2, 1888.
Platybema rugosum Ortmann, Dec. u. Schiz. Plankton-Exp., 47, 1893.

Robust and dorsally arcuate. Dorsal crest armed with teeth from posterior margin of carapace to under surface of distal extremity of rostrum; posterior teeth larger than rostral. Inner and outer canthus of orbit furnished with a small tooth. Fronto-lateral angle of carapace produced to a prominent point, the lateral walls adorned with spines or tubercles. A straight row of spines extends from fronto-lateral angle to posterior margin of carapace. The surface above this row is furnished with scattered spines. Pleon having the anterior two segments elevated in front so that, when viewed laterally, the elevations resemble teeth; the third and succeeding somites smooth, except sixth, which is dorsally armed with two transverse rows of spines, three across the middle and four on posterior margin. Telson having the lateral and distal margins furnished with small spines.

Dimensions of ovigerous female: Length, 21 mm.; length of carapace and rostrum, 9.5 mm.; length of rostrum, 3 mm.

Mayaguez, on coral reef; off Vieques Island, 16 fathoms, station 6092; off Culebra, 14¾ to 15 fathoms, stations 6086, 6093; off St. Thomas, 20 to 23 fathoms, station 6079.

Bate (*loc. cit.*) had one specimen said to come from off Culebra Island, 390 fathoms, but some doubt is cast on the correctness of this locality by the statement, on page 859 of the same work, that it was associated with *Leptochela serratorbita* at St. Thomas in shallow water. Ortmann (*loc. cit.*) has noted this discrepancy.

Distribution: Gulf of Mexico, 25 to 38 fathoms, stations 2369 to 2374 (*Albatross*) and stations 5073 and 5093 (*Grampus*); off Dry Tortugas, 26 fathoms, station 2414 (*Albatross*); off Cape Catoche, Yucatan, 24 fathoms, station 2365 (*Albatross*); off mouth of Tocantins, 50 to 100 meters (Ortmann).

Genus LATREUTES Stimpson.

Latreutes Stimpson, Proc. Acad. Nat. Sci. Phila., XII, 27 (96), 1860.

Resembles *Platybema*. Rostrum elongate, more than half the length of carapace, laterally compressed and deep. First pair of antennæ subequal in length to rostrum. Second pair with an acutely pointed scale. Mandibles without cutting edge or palp. Second maxillipeds seven-jointed. Carpus of second pair of feet triarticulate. Pleopoda biramose, branches subequal. Telson tapering to a point.

Latreutes ensiferus (Milne Edwards).

Hippolyte ensiferus Milne Edwards, Hist. Nat. Crust., II, 374, 1837.
Latreutes ensiferus Stimpson, Proc. Acad. Nat. Sci. Phila., XII, 27 (96), 1860; Bate, *Challenger* Rept., Zool., XXIV, 583, pl. CIV, f. 1, 1888.

Body slender and but slightly sinuous at third segment of pleon. Carapace dorsally rounded, armed with a small median spine on gastric region. Rostrum nearly as long as carapace, vertically broad, of extreme tenuity, slightly curved upward on upper surface toward apex; extremity serrate, lower margin smooth and curved downward in middle. Antero-lateral angle of carapace serrate, with five to eight small spines. First pair of feet short and robust; merus and carpus each excavate to receive succeeding segment; the upper distal angle of carpus projects over propodus and is tipped with a fascicle of long hairs. The propodus articulates with carpus at lower angle and is broader at this extremity than at dactyloid; dactylus broad and spoon-shaped, corresponding in length with pollex. Second pair of feet longer than first, slender, feeble; carpus triarticulate, central segment the longest, and together the three are longer than propodus, of which the fingers are nearly half the length. Third, fourth, and fifth pairs with long spines on under side of propodi, and a series of small spines on dactyli, which are biunguiculate.

Dimensions of female: Length, 15.5 mm.; length of carapace and rostrum, 6.3 mm.; length of rostrum, 3 mm.

Mayaguez; Boqueron Bay. Common in floating Gulf weed in the North Atlantic.

Genus TOZEUMA Stimpson.

Tozeuma Stimpson, Proc. Acad. Nat. Sci. Phila., XII, 26 (95), 1860.

Body greatly elongate, lanceolate, diminishing at both ends, compressed. Rostrum slender, very long, sometimes scarcely shorter than rest of body. Antennulæ short, biflagellate. Antennal scale long. Mandibles rather stout, strongly incurved, not divided nor palpigerous. External maxillipeds very short, without exognath or flagellum. Feet short, without epipods; first pair very short, stout, chelate; second pair filiform, chelate, carpus triarticulate. Abdomen armed with teeth on dorsum; last article elongate, almost lanceolate.

Tozeuma carolinense Kingsley.

Tozeuma carolinensis Kingsley, Proc. Acad. Nat. Sci. Phila., XXX, 1878, 90 (2); Proc. Acad. Nat. Sci. Phila., XXXI, 1879, 413, pl. XIV, f. 8 (1880).

Rostrum a little more than half the length of remainder of body, rounded and unarmed above, at base somewhat flattened and horizontal, distally inclined slightly upward; below serrated, and toward the base lamellate, the teeth becoming more distant toward extremity. A spine on either side at base of rostrum; a second at antero-lateral angle. Outer flagellum of antennulæ thick and much shorter than inner. Antennæ longer than rostrum; scale lanceolate, equaling or exceeding antennulæ, but less than half the length of rostrum. Abdomen strongly geniculated on posterior part of third segment, where there is a somewhat truncated protuberance, more prominent in the male than in female. Posterior margin of fifth segment with a spine on each side; of sixth segment with a lateral spine above telson and a postero-lateral spine. Telson with two pairs of dorsal spinules, posterior margin with two long submedian spinules, and one short spinule on each side.

Dimensions of female: Length, 40 mm.; length of carapace and rostrum, 20.5 mm.; length of rostrum, 13.7 mm.

Boqueron, Porto Rico, 1 specimen.

Fort Macon and Beaufort, N. C. (Kingsley); Charlotte Harbor, Fla. (Kingsley). Specimens are in the National Museum from Cedar Keys, Fla. (Lieut. J. F. Moser, U. S. N., U. S. Coast Survey steamer *Bache*, coll.); off St. Martins Reef, 17 feet (Moser, coll.); Anclote Sponge Station, Tarpon Springs (B. W. Evermann, coll.); Charlotte Harbor (W. H. Dall, coll.); Big Gasparilla (*Grampus*); Punta Rassa, 1 fathom (H. Hemphill, coll.); Marco (*Grampus*), 1 to 3 fathoms (H. Hemphill, coll.); Key West, surface with electric light (*Albatross*); Cape Florida (U. S. Fish Commission); Shamrock Point, Corpus Christi, Tex. (B. W. Evermann, coll.); Andros Bank, Bahamas (F. Stearns, coll.); Jamaica, Cozumel (in seine), Old Providence and St. Thomas (*Albatross*).

Genus HIPPOLYSMATA Stimpson.

Hippolysmata Stimpson, Proc. Acad. Nat. Sci. Phila., XII, 26 (95), 1860.

Carapace provided with a rostrum of moderate length, vertically dilated and dentate. Antennulæ furnished with two long flagella. Mandibles strongly incurved, not divided into two parts nor palpigerous. External maxillipeds elongate, provided with an exognath and flagellum; last article slender. First to fourth feet provided with epipods. First pair of feet small, thick, hand oblong, second pair filiform, carpus multiarticulate. Abdomen dorsally smooth.

Key to the Porto Rican species of the genus Hippolysmata.

A. One median spine on carapace posterior to rostrum and anterior to middle..*moorei*

A′. Two or three median spines on carapace posterior to rostrum, the hinder of these spines at middle of carapace. *intermedia*

Hippolysmata moorei, sp. nov.

Carapace dorsally carinated in anterior half, a spine at anterior fourth. Rostrum reaching the middle of second antennular segment, bent down toward extremity, armed above with three or four teeth, and below with two smaller teeth near extremity. Anterior margin with a strong antennal spine. Eyes very short and stout, the axial diameter not exceeding transverse. Cornea black in alcohol. Antennulæ stout; peduncle short; last two segments broader than long; a very slender inner flagellum as long as body, and a stout outer flagellum about two-thirds the length of the carapace and bearing on its outer margin at about the tenth segment (in large specimens) a long slender flagellum similar to innermost one. Antennal scale broad, tapering, truncate, with a very small antero-lateral spine. Peduncle reaching to about the middle of penultimate segment of antennular peduncle; flagellum slender, as long as body. Outer maxillipeds reaching end of antennal scale. First pair of feet with carpus and palm subequal in length; fingers half as long as palm. Carpus of second pair about seventeen-articulate; distal segment about as long as palm; fingers shorter. Telson narrow, blunt-pointed, armed with two pairs of slender spines forming a square near middle, and two spines at extremity. Caudal laminæ exceeding telson, inner lamina narrower than outer.

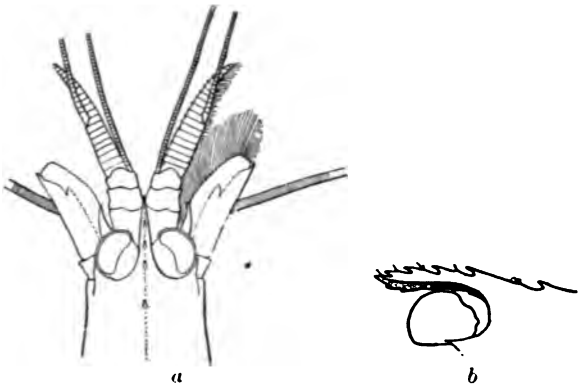

FIG. 23.—*Hippolysmata moorei*. (*a*) Anterior portion, dorsal view, × 5. (*b*) Rostrum, side view, × 10.66.

Dimensions of female: Length, 20.3 mm.; length of carapace and rostrum, 7.5 mm.; length of rostrum, 2.4 mm.

Type locality, Playa de Ponce, 14 specimens (Cat. No. 23787).

The short antennular peduncles and antennal scale easily distinguish this species from all others.

Named for Dr. H. F. Moore, naturalist of the *Albatross*, who accompanied the *Fish Hawk* on its cruise to Porto Rico.

Hippolysmata intermedia Kingsley.

Hippolysmata intermedia Kingsley, Proc. Ac. Nat. Sci. Phila., XXX, 1878, 90, (2); Bull. Essex. Inst., XIV, 128, pl. I, f. 4 1882.

Carapace carinated for its anterior two-thirds. Crest horizontal, armed with six teeth, two or three on carapace, the remainder on rostrum; posterior dorsal tooth at middle of carapace. Rostrum sharp-pointed, with two inferior teeth and reaching end of penult segment of antennular peduncle. A strong antennal and a small pterygostomian spine. Antennulæ with stout flagellum longer than carapace, fringed with long hair, and bearing the outer slender flagellum at twentieth segment in large specimens. Antennal scale longer and more slender than in *H. moorei*. Peduncle just reaching penult segment of antennular peduncle; flagellum 1.5 times length of body. Outer maxillipeds exceeding antennal scale by half the length of terminal joint. Carpus and propodus of first pair of feet subequal; palm narrower than in *H. moorei;* fingers one-third the length of palm. Second pair of feet more slender than in *H. moorei;* carpus with about thirty articles. Telson similar to that of *H. moorei.*

Dimensions of female with eggs: Length, 20.5 mm.; length of carapace and rostrum, 8 mm.; length of rostrum, 3 mm.

Porto Rico: Mayaguez Harbor; off Vieques, 12½ fathoms, station 6095; Ensenada Honda, Culebra. No Name Key, Fla., banks, low tide (H. Hemphill, coll.); Key West (H. Hemphill, coll.); Tortugas (Kingsley); St. Thomas (Nobili); Pim Bay, Fayal, Azores (Lewis Dexter, coll.).

Genus THOR Kingsley.

Thor Kingsley, Proc. Acad. Nat. Sci. Phila., XXX, 1878, 94 (6).

Carapace with antennal spine; rostrum short, toothed above; antennulæ biflagellate, outer branch very stout. Mandibles without palpi, bifurcate, apical process narrow; proximal process stout with one acute and one obtuse tooth and a pubescence of minute curved hooks. External maxillipeds pediform, exopodite present. Feet of first pair short, stout; of second elongate, slender; carpus five-annulate. Telson elongate, triangular.

Thor floridanus Kingsley.

Thor floridanus Kingsley, Proc. Acad. Nat. Sci. Phila., XXX, 1878, 95 (7); Proc. Acad. Nat. Sci. Phila., XXXI, 1879, 421, pl. XIV, f. 6, 1880.

Carapace with a small antennal spine. Rostrum shorter than eyes, four to five toothed above, the first tooth over orbits, the distal tooth so near the end as to make it appear bifid; unarmed below. Antennulæ with basal joint large, basal spine long, acute, reaching half the length of third joint; second and third joints very short, the second with a slender, acute spine on outside, the third with a thin, flat, blunt projection on upper side; inner flagellum slender, slightly longer than peduncle; outer about as long as peduncle, stout, ciliated on apex and inner margin. Antennæ with a spine on basal joint; antennal scale reaching as far or nearly as far as outer branch of antennular flagellum, its inner margin slightly concave; flagellum three-fourths as long as body. External maxillipeds slender, reaching tip of antennal scale, penult joint the shortest, antepenult three and last joint four times as long as penult, the last joint terminating with slender spines. First pair of feet with meral and carpal joints subequal, the latter with minute spinules on inner margin; hands subcylindrical, the dactyli occupying two-fifths their length. Meral joint of second pair of feet as long as first three carpal joints; first carpal joint the longest, second joint next in size, fifth next; third and fourth subequal, together equal to first. Hand as long as fourth and fifth articulations of carpus, the fingers being two-fifths of its length. Dactyli and propodi of remaining feet spinulose beneath. Telson with apex truncate, spined.

Length of adult female, 10.5 mm.; length of carapace, 3.2 mm.

Porto Rico: Mayaguez on coral reef; Puerto Real; Playa de Ponce Reef; off St. Thomas, 20 to 23 fathoms, station 6079; Ensenada Honda, Culebra.

Key West (type locality); Harbor Key and Sarasota Bay, Fla. (Kingsley).

Specimens in National Museum from Anclote Sponge Station, Tarpon Springs, Fla. (Evermann); Punta Rassa, 1 fathom (H. Hemphill); Marco, 1 to 3 fathoms, among sponges (H. Hemphill); No Name Key, among algæ, low tide (H. Hemphill); Key West (*Albatross*), among algæ below low tide (H. Hemphill); Key West Harbor (E. Palmer); Dry Tortugas (E. Palmer), Gulf of Mexico, 25 fathoms, station 2370 (*Albatross*); off Cape Catoche, Yucatan, 24 fathoms, station 2365 (*Albatross*); St. Thomas (*Albatross*).

Family PANDALIDÆ Kingsley, 1878 (Pandalinæ); Bate, 1888.

Rostrum long and slender, armed with teeth or spines. Eyes well developed. Mandibles with a two or three-jointed palp. First pair of trunk-legs not chelate, second pair chelate, carpus subdivided. Pleopods biramous; tail-fan well developed and strong.

Key to the Porto Rican genera of the family Pandalidæ.

A. Rostrum not articulated with frontal margin of carapace .... *Pandalus*
A'. Rostrum articulated with frontal margin of carapace .... *Pantomus*

Genus PANDALUS Leach.

Pandalus Leach, Edinburgh Encyc., VII, 432, 1814.

Anterior portion of carapace carinated. First pair of antennæ usually not longer than carapace; spine on the outer margin of their basal joint obtusely pointed. Outer maxillipeds and first pair of legs slender.

Pandalus longicauda, sp. nov.

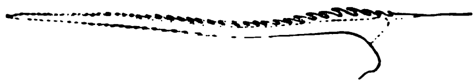

FIG. 24.—*Pandalus longicauda*, rostrum, × 4.

Rostrum twice as long as carapace, nearly horizontal. At the posterior sixth of carapace, a small, blunt median spine; in front of this arises the median crest which is unarmed posteriorly, anteriorly with about forty small, fixed spines, of which two or three are on the carapace, the remainder on the rostrum. Spines larger posteriorly than anteriorly. Lower edge of rostrum armed with about thirty spines, a little finer and more appressed than the superior spines. A perfect ocellus or secondary eye is situated on the posterior surface of the ophthalmopod. Antennular flagellum as long as the carapace and rostrum, in this respect resembling the genus *Pandalopsis* Bate. Stylocerite oval, subacute. Antennal scale as long as carapace. Outer maxillipeds a little longer than antennal scale. Propodal and terminal segments subequal. The propodus of the first pair of feet reaches the end of antennal scale. Carpus and dactylus subequal; propodus 1.5 times as long as carpus. The feet of second pair are subequal and reach the end of antennal scale. Carpus 1.5 times as long as merus and about twenty-jointed; proximally the divisions are very faint; distal segment about 3 times the next one, which is subequal to each of the four succeeding. Palm a little wider and about as long as adjacent carpal segment; fingers of the same length. The carpus of fifth pair of feet overreaches antennal scale; propodus 1.5 times as long as carpus; the dactylus very short, less than one-tenth the propodus. Sixth abdominal segment much compressed and 3 times the length of fifth; it has a median groove with a carina on each side. Seventh segment dorsally grooved; of its three pairs of dorsal aculei, the anterior pair is about at the middle of length of segment.

Male: Length, about 44 mm.; length of carapace and rostrum, 18.5 mm.; length of rostrum 12.5 mm.; length of flagellum of antennula, 20 mm.; length of sixth abdominal segment, 6.8 mm.

This species may readily be distinguished by the spine on the posterior part of the carapace. In the fixed rostral teeth and long first antennæ it resembles *Plesionika* Bate; in the ocellus it resembles *Nothocaris*, while the stylocerite is that of *Pandalus*.

Mayaguez Harbor, 220 to 225 fathoms, station 6070, 2 specimens.

The Porto Rican examples being in poor condition, I have taken as types two examples collected by the *Albatross* in the Gulf of Mexico, lat. 28° 42' 30" N., long. 85° 29' W., 88 fathoms, station 2403 (U. S. Nat. Mus. No. 23568).

PANTOMUS A. Milne Edwards.

Pantomus A. Milne Edwards, Recueil de Figures de Crustacés nouveaux ou peu connus, pl. 26, 1883.

Near *Pandalus*, but with the rostrum articulated with frontal margin of carapace. According to Bate,[1] the rostrum "seems to have the power of movement to a slight extent in any direction at the will of the animal; this modification can be due only to one purpose, that of receiving the shock of an approaching enemy directly on its point rather than obliquely."

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[1] Challenger Rept., XXIV, p. viii, 1888.

Pantomus parvulus A. Milne Edwards.

Pantomus parvulus A. Milne Edwards, Recueil de Figures de Crustacés nouveaux ou peu connus, pl. 26, 1883.

Rostrum longer than carapace, terminal half ascending. Anterior half of carapace carinated and armed with three spines, the two posterior being nearer together and movable, the anterior situated at articulation of rostrum; three spines on basal half of rostrum, increasing in size from the posterior to anterior. Lower margin armed with numerous slender overlapping spines. Tip bifid. Antennal scale reaching two-thirds the length of rostrum. Outer maxillipeds and first pair of thoracic feet reaching end of antennal scale. One foot of second pair longer than first pair, carpus with fifteen to seventeen articles; the other foot of second pair shorter than first pair, carpus with ten to twelve articles. Third, fourth, and fifth pairs subequal, exceeding the second pair. Third abdominal segment carinated in its posterior half; sixth segment elongate, 2.5 times as long as fifth.

Length of ovigerous female, station 2403, about 30 mm.

Mayaguez Harbor, 75 to 76 fathoms, station 6063, 1 specimen; Mayaguez Harbor, 97 to 120 fathoms, station 6067, 1 specimen.

Distribution: Northern part of Yucatan Bank, latitude 23° 13′ N., longitude 89° 16′ W., 84 fathoms, station 36, *Blake* (type locality); off Frederickstadt, Santa Cruz, 248 fathoms, station 134, *Blake* (Faxon); Gulf of Mexico, off Cape San Blas, Fla., 88 fathoms, station 2403 (*Albatross*); off Cape Lookout, N. C., 124 fathoms, station 2602 (*Albatross*).

Family ATYIDÆ Kingsley, 1878.

Carapace dorsally smooth; scale of second antennæ short. Mandibles with a molar process and cutting edge, but no palp. Third maxillipeds four-jointed and pediform. First and second trunk-legs chelate with spoon-shaped fingers; carpus of second pair not subdivided. Telson flattened, truncate.

Key to the Porto Rican genera of the family Atyidæ.

A. Pereiopoda with exopodites. Carpal joints of first two pairs not distally excavated .... *Xiphocaris*
A′. Pereiopoda without exopodites. Carpal joints of first two pairs distally excavated.
  B. Both fingers of each hand subequal in size; no palma developed .... *Atya*
  B′. Movable fingers shorter than the immovable part of the hand, the latter distinctly divided into a palmar portion and an immovable finger .... *Ortmannia*

Genus XIPHOCARIS von Martens.

Xiphocaris von Martens, Arch. f. Naturg., XXXVIII, pt. 1, 139, 1872; Ortmann, Proc. Acad. Nat. Sci. Phila. 1894, 400.

Rostrum slender, compressed, dentate, usually long. All the pereiopoda slender and with exopodites; carpal joints of first two pairs without a distal excavation, articulating in a normal way with the proximal end of the propodus. Abdomen with sixth segment elongate; telson slender, truncate at tip.

Xiphocaris elongata (Guérin).

Hippolyte elongata Guérin, in La Sagra's Hist. Cuba, vol. VII, p. XX; vol. VIII, pl. II, f. 16, 1857.
Xiphocaris elongata von Martens, Arch. f. Naturg., XXXVIII, pt. 1, 140, 1872; Ortmann, Proc. Acad. Nat. Sci. Phila. 1894, 400, and synonymy.

In typical specimens the rostrum is from 1 to 1.66 times as long as the remainder of the carapace, its carina prolonged only a little way on carapace; horizontal for its basal fifth, then inclined upward at an angle of about 30 degrees; upper margin armed in its basal, horizontal portion with ten to fifteen crowded spines, remainder entire; lower margin armed with numerous spines beginning near anterior end of superior row and extending to the extremity, which is obliquely truncate and armed with a few spines. Carapace behind anterior fifth smooth and rounded. An outer orbital tooth present. Second segment of peduncle of the inner antennæ 1.5 times as long as the third. Upper and outer flagellum as long as rostrum, its basal half thickened; inner and lower flagellum slender, longer than carapace and rostrum. Flagellum of outer antenna as long as body; scale reaching to middle of rostrum, its sides parallel, extremity rounded, prolonged a considerable distance beyond outer spine. First pair of feet reaching to end of first antennular segment; second pair more slender and reaching to or beyond the end of antennular peduncle. Third, fourth, and fifth pairs diminishing very slightly in the order named, the third pair being a little longer or shorter than second. Sixth abdominal segment nearly twice as long as fifth.

Length, 57 mm.; length of carapace and rostrum, 24 mm.; length of rostrum, 14.2 mm.

Varieties occur with much shorter rostrum, having the appearance of typical specimens from which a portion of the rostrum has been broken off. In the Porto Rican specimens from El Yunque the rostrum extends to the end of the first antennular segment or to the middle of second segment. This form is equivalent to *Xiphocaris brevirostris* Pocock. In the individuals from Rio Grande de Arecibo the rostrum extends to the end of the second antennular segment or to the middle of the third. This form is *Xiphocaris gladiator* Pocock. The specimens from the other localities are typical. It may be noted also that while the different forms are represented by specimens of equal length, the *brevirostris* form is thicker than the *gladiator* or than the typical *elongata*.

Porto Rican localities: Rio Caguitas, Caguas, 75+ specimens; Rio Grande, near mouth of Rio Caguitas, 5 specimens; Rio Bayamon, 15 specimens; Rio Grande de Arecibo, at the falls (A. B. Baker, coll.), 2 specimens (rostrum of the form of *Xiphocaris gladiator* Pocock); El Yunque, 31 specimens; Rio Arecibo (Gundlach).

Known only from the fresh waters of the Antilles: Cuba (Guérin, von Martens); Haiti (Saussure); Santo Domingo (Sharp); Dominica (Pocock); Port Castries, St. Lucia, in small brook (*Albatross*).

ATYA Leach.

Atys Leach, Trans. Linn. Soc. London, XI, 345, 1815. (Preoccupied.)
Atya Leach, Zool. Misc., III 29, 1817.
Atyoida Randall, Jour. Acad. Nat. Sci. Phila., VIII, 140, 1839; A. Milne Edwards, Ann. Soc. Entom. France (4), IV 151, 1864.

Rostrum short, flat, and broad at the base, horizontal or depressed. Pereiopoda without exopodites; first two pairs short, with carpal joints distally deeply excavate, infero-distal angle articulating with outer margin of propodus; propodus and dactylus subequal in size and fringed with long hair; no distinct palm; third pair of feet large and long; third and fourth pairs diminishing successively in size. Abdomen with sixth segment not elongate; telson broad, rounded at the end.

Atya scabra Leach.

Atys scaber Leach, Trans. Linn. Soc. London, XI, 345, 1815.
Atya scabra Leach, Zool. Misc., III, p. 29, pl. 131, 1817; Ortmann, Proc. Acad. Nat. Sci. Phila. 1894, 409, and synonymy

Rostrum reaching nearly or quite to end of first antennular segment and with a median and a lateral carina; either triangular or with lateral carina terminating in a tooth above eye. Carapace deeply punctate; anterior margin with an external orbital and a branchiostegâl tooth or spine. First and second pairs of feet subequal, terminal hairs reaching to or beyond antennal scale. Third, fourth, and fifth pairs of feet covered with short spines. In typical specimens the third pair of feet are very heavy, the merus being much swollen between middle and distal end; carpus and propodus subequal in length; dactylus very short. Fourth and fifth pairs much shorter and more slender, subequal in thickness.

This species is extremely variable in the form of the rostrum and more noticeably in the shape of the last three pairs of thoracic feet, which may all be slender and nearly equal in length; and their spines very feeble and appressed. These differences are independent of sex or size, and probably represent different stages in the growth of the individual.

Length of Porto Rican specimen, a male with feet of third pair stout, 66 mm.; length of carapace and rostrum, 26.8 mm.; of rostrum, 4 mm. Length of male specimen with feet of third pair slender, 80.5 mm.; length of carapace and rostrum, 29 mm; of rostrum, 6.5 mm.

Porto Rican localities: San Juan market; Mayaguez, fresh water; Falls of Rio Grande de Aibonito; Falls of Rio Grande de Arecibo (A. B. Baker, coll.); El Yunque; a tributary of the River Añasco, and San Juan market (Gundlach).

Common to the fresh waters of Mexico, Nicaragua, Costa Rica, West Indies, West Africa and adjacent islands; Orinoco; Venezuela (Lyon and Robinson coll.).

Common name, *Guábara* (Gundlach).

Genus ORTMANNIA, nom. nov.[1]

Atyoida Ortmann, Proc. Acad. Nat. Sci. Phila. 1894, 406. (Not *Atyoida* Randall.)

Differs from *Atya* chiefly in the character of the chelæ of the first and second pairs of legs; the dactylus is inserted on the upper margin of the propodus and is shorter than the latter, forming a chela consisting of a palmar portion and two fingers, as is usual in the Decapoda.

Ortmannia potimirim (F. Müller).

Atyoida potimirim F. Müller, Kosmos, IX, 117, figs. 1-20, 1881; Arch. Mus. Nac. Rio de Janeiro, VIII, 155, pls. IX and X, 1892. Ortmann, Proc. Acad. Nat. Sci. Phila. 1894, 407; Rev. Mus. Paulista, II, 183, pl. I, figs. 1-3, 1897.

Rostrum shorter than antennular peduncle, narrow, acute, having a superior unarmed median carina, and two or three teeth below. Carapace smooth; anterior margin furnished with suborbital spine; also a branchiostegal spine in the female, none in male. Feet all slender, those of the second pair reaching the end of the antennular peduncle. Carpus of second pair nearly as long as its propodus and much longer than carpus of first pair. Meral joints of third, fourth, and fifth pairs armed with a few spines below, the propodi and dactyli have many smaller and more slender spines.

Length, from 15 mm. in the male to 25 mm. in the female, according to Müller.

Vieques Island in small stream (Dr. L. Stejneger, coll.); 1 male.

Hitherto known only from Brazil, where it has been taken in the Itajahy River and at São Sebastião in the sea.

Family PONTONIIDÆ Kingsley, 1878 (Pontoninæ): Bate, 1888.

Body often depressed; rostrum often short, compressed or depressed with or without dentations. Outer flagellum of first antenna consisting of a thick hairy part, bearing a thin hairless part, the latter usually arising from the former at a short distance from the free end, and thus giving it a bifid appearance. Mandible deeply cleft into two divisions and without a palp; endopodite of the second maxilliped not biramous; third maxilliped pediform, but usually with some of the joints broadened. All the legs without exopodites or mastigobranchs; first two pairs of legs chelate, first pair slender; second pair larger than first, not foliaceous. Mode of life often semiparasitic. (Borradaile.)

Key to the Porto Rican genera of the family Pontoniidæ.

A. Dactyli of last three pairs of legs slender, nearly straight, without basal protuberance .... *Periclimenes*
A′. Dactyli of last three pairs of legs short, curved, with a basal protuberance.
  B. Antennal scale long .... *Coralliocaris*
  B′. Antennal scale short .... *Pontonia*

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[1] The National Museum has lately received from Mr. H. W. Henshaw, Hilo, Hawaii, two species of river shrimp belonging to the family *Atyidæ*. One is a true *Atya*, the other belongs to the genus *Atyoida* as defined by Ortmann (Proc. Acad. Nat. Sci. Phila. 1894, 406). Either corresponds to Randall's brief description of *Atyoida bisulcata*. Randall, however (Jour. Acad. Nat. Sci. Phila., VIII, 1839, 140), says that *Atyoida* is essentially similar to the genus *Atya*, "excepting the third pair of feet"; this would seem to imply that the first two pairs of feet are similar to those of *Atya*, which is not the case in *Atyoida* as defined by Ortmann.

Through the courtesy of Mr. Witmer Stone, of the Academy of Sciences of Philadelphia, I have been able to examine a dried fragment (all that remains) of Randall's type of *Atyoida bisulcata*. It comprises a carapace and a foot of both the first and second pairs. These are without doubt feet of typical *Atya*, and the species is seemingly identical with one of those received from Mr. Henshaw; it is that figured by Dana and by Bate. The genus *Atyoida* Randall is therefore a synonym of *Atya* Leach. In *Atya* (to quote Dr. Ortmann) the "dactylus [of the chelæ] articulates with the propodus on the posterior end of the latter, both joints being exactly alike and forming a hand of a very peculiar shape among the Decapoda, the palmar portion being wholly reduced, and the hand consisting only of two fingers about alike in size and connected with each other at the posterior ends."

In the genus *Atyoida* Ortmann (non Randall) for which I propose the name *Ortmannia*, "the hands are formed like those of *Caridina*, the dactylus is inserted on the upper margin of the propodus, being shorter than the latter and forming a chela, as usual in the Decapoda, consisting of a palmar portion and two fingers." The type is *Ortmannia henshawi* nom. nov. (= *Atyoida bisulcata* Ortmann, 1894, not Randall = *Atya bisulcata* Sharp, 1893, in part, Cat. No. 162), from Kaiwiki, Hilo, Hawaii, 1,800 feet altitude, 3 miles from the sea, H. W. Henshaw, collector (U. S. Nat. Mus., Cat. No. 24825).

Genus PERICLIMENES Costa.

Periclimenes Costa, Ann. Ac. degl. Aspir. Nat. Nap., II, 1844; Faun. Reg. Nap., II, 1, 1846 (*teste* Borradaile); Borradaile, Ann. Mag. Nat. Hist. (7), II, 380, 1898, and synonymy.

Rostrum long, compressed, usually dentate, in side view diminishing gradually to a sharp point at free end, not bent downward; thicker flagellum of first antenna long or moderate, bifid; scale of second antenna long, usually narrow; second maxilliped with penultimate joint as broad as—usually broader than—the last joint, which it bears terminally; third maxilliped narrow, the last two joints together may be longer or shorter than the preceding joint; dactyls of last three pairs of legs slender, nearly straight, without basal protuberance. (Borradaile.)

Periclimenes americanus (Kingsley).

Anchistia americana Kingsley, Proc. Acad. Nat. Sci. Phila., XXX, 1878, 96 (8); Bull. Essex Inst., XIV, 109, pl. II, f. 10, 1882.
Periclimenes americanus Borradaile, Ann. Mag. Nat. Hist. (7), II, 383, 1898.

Rostrum reaching nearly to end of antennal scale, upper margin straight, directed slightly upwards, seven to nine-toothed; two teeth on carapace proper; posterior one at anterior two-fifths of carapace, and farther from second than the remainder are from each other; two to three teeth on lower margin. Hepatic and antennal spines present. Basal joint of antennulæ very broad, and as long as next two joints together, and with an antero-lateral spine; the thick upper and outer flagellum bifid for one-fourth its length; lower flagellum as long as peduncle. Basal joint of antennæ with an outer distal spine; peduncle not reaching end of first antennular segment; scale slightly overreaching antennular peduncle; distal spine longish; flagellum as long as body. Last two joints of outer maxilliped together are longer than preceding joint.

First pair of feet very slender, elongate, end of carpus reaching tip of antennal scale; merus and carpus subequal in length; propodus two-thirds the carpus; fingers shorter than palm. Second pair of feet very elongate, as long as or longer than body; merus a little longer than carpus, which is more than half as long as palm and is distally enlarged.

Palm cylindrical, slightly compressed; fingers about two-fifths as long as palm, slightly deflexed, armed with a few small teeth, when closed leaving hiatus. Third, fourth, and fifth pairs of feet long and slender, the fifth pair reaching end of rostrum.

Dimensions of Culebran specimen: Length, 14.7 mm.; length of carapace and rostrum, 5.3 mm.; length of second foot, 15 mm.

This species was found at the following Porto Rican localities: Mayaguez; Mayaguez Harbor; off Puerto Real, 8½ fathoms, station 6074; Ponce, on coral reef; off Humaçao, 9¼ fathoms, station 6099; off Vieques, 6 to 15 fathoms, stations 6085, 6091, 6096; Ensenada Honda, Culebra; off St. Thomas, 20 to 23 fathoms, station 6079.

Also occurs at Key West (type locality); Florida (H. Hemphill, coll.), at Orange Bluff, Clearwater Harbor, 1 to 2 fathoms; Sarasota Bay, Punta Rassa, 1 fathom; Marco, 1 to 3 fathoms, and Key West. Gulf of Mexico, 26 and 33½ fathoms, stations 2406 (*Albatross*) and 5072 (*Grampus*); off Cape Catoche, Yucatan, 24 fathoms, station 2365 (*Albatross*); Old Providence (*Albatross*); Port Antonio, Jamaica (J. E. Duerden, coll.); St. Thomas, W. I. (*Albatross*); Bermudas.

Genus PONTONIA Latreille.

Pontonia Latreille, Cuvier's Règne Animal, 2d ed., V, 96, 1829.

Body depressed; rostrum short, depressed, bent downward, not dentate, with or without a keel below at the free end; both flagella of first antenna short, the thicker of the two bifid; scale of the second antenna of moderate length, broad; flagellum of same not short; second maxilliped with penultimate joint broader than the last joint and bearing it terminally; third maxilliped with last two joints narrow, together shorter than the preceding joint, which is broad; dactyls of the last three legs straight or little curved, without basal protuberance; one of the second pair of legs with very large chela.

Pontonia grayi, sp. nov.

Rostrum reaching middle of the penult segment of the antennular peduncle. Antennal spine slender, sharp, inclined upward. Antennal scale reaching the end of the antennular peduncle. Large cheliped of second pair with small cup-shaped carpus; palm compressed, dilated, nearly twice as long as broad; dactylus a little longer than the width of the palm, narrow, cylindrical, with a large tooth at the basal third fitting between two large teeth on the pollex, which is broad and flat. Dactyls of last three legs slightly curved and with a subterminal as well as a terminal spine.

Length of female with ova, 20.5 mm.; length of carapace, 8.8 mm.

Nine specimens were taken between San Antonio Bridge and San Geronimo, San Juan, Porto Rico, by Mr. G. M. Gray (types, Cat. No. 23789); a very small specimen without claws, and of seemingly the same species, was dredged by the *Fish Hawk* off Vieques Island, in 16 fathoms, station 6092.

This species is in general appearance remarkably like *P. domestica* Gibbes, which has, however, the dactyli of the last three pairs of feet strongly curved and with a strong basal protuberance, a character which throws it into the genus *Conchodytes*, according to Borradaile. *Pontonia mexicana* Guérin is represented with a much shorter and less slender rostrum and smaller antennal scale. It also attains a larger size (length, 35 mm.).

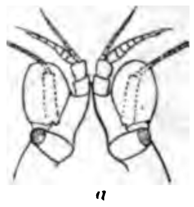

FIG. 25.—*Pontonia grayi*. (*a*) Female, anterior portion, × 5.38. (*b*) Dactylus of one of last three pairs of legs, much enlarged.

Genus CORALLIOCARIS Stimpson.

Œdipus Dana, Crust. U. S. Expl. Exped., I, 572, 1852. (Preoccupied.)
Coralliocaris Stimpson, Proc. Acad. Nat. Sci. Phila., XII, 38 (107), 1860.

Rostrum long or moderate, with or without dentations, usually somewhat depressed, shallow, at most only slightly bent downward, flagella of first antenna of moderate length, thicker of the two bifid; scale of second antenna long, broad; flagellum of same not short; second maxilliped with last joint as broad as or broader than penultimate joint, which bears it terminally; third maxilliped with antepenultimate joint moderately broad, last two joints of about the same breadth as, and together as long as or longer than, the antepenultimate; chelæ of second pair large; dactyls of last three legs short, strong, curved, with a large basal protuberance on under side. (Borradaile.)

Coralliocaris atlantica, sp. nov.

Rostrum in a line with the dorsal surface of the carapace, serrated above, with four teeth, all in front of orbital sinus; below unarmed; extremity acuminate; reaching middle of penult segment of antennular peduncles. Eyes subspherical, not reaching penult segment of antennular peduncle; cornea of lesser diameter than stalk and situated on its antero-external surface. Antennular peduncles extending beyond the eyes to a distance equaling length of eye-stalks; flagella fringed with setæ. Carpus and propodus of first pair of feet subequal and a little shorter than merus; palm and fingers subequal; carpus increasing in width distally; fingers setose; chelæ broadest in middle, tapering toward carpus and toward finger tips. Palm of right cheliped of second pair about twice as long as broad; upper margin straight; lower margin slightly inclining toward upper distally; fingers about half as long as palm; pollex triangular, broad at base, slender at tip; dactylus narrow and curved; carpus cup-shaped, less than half as long as palm. Left cheliped of second pair missing. In the last three pairs of feet the propodus is half again as long as carpus and has a few spinules on its lower side near extremity. Dactylus very short and stout, with a moderate protuberance on lower side.

Length, 5.5 mm.

Type locality, off St. Thomas, 20 to 23 fathoms, station 6079, 2 specimens (Cat. No. 23788).

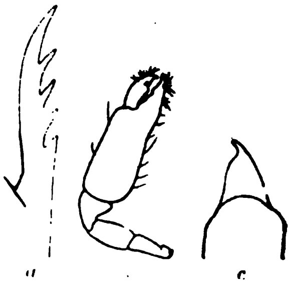

FIG. 26.—*Coralliocaris atlantica*. (*a*) Rostrum, much enlarged. (*b*) Right cheliped of second pair, × 10. (*c*) Dactylus of one of last three pairs of legs, much enlarged.

Family PALÆMONIDÆ Leach, 1819.

Carapace dorsally rounded and laterally compressed; rostrum long, laterally compressed and generally armed with teeth. Eyes well developed and pyriform. First antennæ with basal joint dorsally hollowed, with a strong spine on outer side, and frequently one of the flagella branched; second pair with a long and narrow foliaceous scale, its rigid outer margin ending in a small tooth. The mandibles have molar tubercle and cutting edge, and either have or have not a palp. Third maxillipeds pediform. First two pairs of trunk-legs chelate, the chelæ of the second pair generally larger than those of first; carpus not subdivided.

Key to the Porto Rican genera of the family Palæmonidæ.

A. Carapace with hepatic spine.
  B. Mandibles with a palp. Body stout. Eyes short and thick .... *Bithynis*
  B'. Mandibles without a palp. Body and eyes elongate .... *Urocaris*
A'. Carapace without hepatic spine. Mandibles with a palp .... *Palæmon*

Genus BITHYNIS Philippi.

Bithynis Philippi, Arch. f. Naturg., XXVI, 1, p. 161, 1860.
Palæmon Stimpson, Proc. Acad. Nat. Sci. Phila., XII, 41 (110), 1860.

Carapace with a single lateral spine on front margin, and behind it a second spine, on hepatic region. Rostrum dentated. Inner antennæ with three flagella. Mandibles with a three-jointed palp. First pair of feet slender, second pair much longer and thicker. Species usually fluviatile, often attaining a large size and with second pair of legs greatly developed.

Key to the Porto Rican species of the genus Bithynis.

A. Large chelipeds with palm cylindrical or nearly so.
  B. Chelipeds rough.
    C. Fingers of large chelipeds covered with a thick felt-like coating of stout setæ .... *acanthurus*
    C'. Fingers naked .... *jamaicensis*
  B'. Chelipeds smooth .... *savignyi*
A'. Large chelipeds with palm swollen and compressed, wider than the carpus .... *olfersii*

Bithynis jamaicensis (Herbst).

Cancer (Astacus) jamaicensis Herbst, Natur. Krabben u. Krebse, II, 57, pl. XXVII, f. 2, 1792.
Palæmon jamaicensis Milne Edwards, Hist. Nat. Crust., II, 398, 1837.
Bithynis jamaicensis Pocock, Ann. Mag. Nat. Hist. (6), III, 10, 1889.

Rostrum about as long as peduncles of inner antennæ; teeth, 11 to 14 above and 3 to 5 below; upper margin strongly arcuate above eyes. Chelipeds of second pair equal—rough in young individuals, but provided with strong spines in the old ones. Carpus considerably shorter than merus, thickened in distal portion. Palm subcylindrical, slightly compressed in old specimens, but not much thicker than contiguous extremity of carpus; more than three times as long as wide. Fingers about as long as palm. Telson rounded at end, on either side two short movable spines.

Length of body of Porto Rican specimen, 21.5 cm.; length of second cheliped, 24.5 cm.

Fresh waters of the Pacific slope, from Lower California to Ecuador; and of the Atlantic slope, from Texas to Rio de Janeiro, including the West Indies. Porto Rican localities: Caguas, Rio Grande; San Juan market; San Sebastian (A. B. Baker, coll.); Arroyo.

Bithynis acanthurus (Wiegmann).

Palæmon acanthurus Wiegmann, Arch. f. Nat., II, pt. 1, p. 150, 1836.
Palæmon forceps Milne Edwards, Hist. Nat. Crust., II, 397, 1837.
Palæmon macrobrachion Herklots, Addit. Faun. Afr. Occ., p. 15, 1851.
Palæmon africanus Kingsley, Bull. Essex Inst., XIV, p. 107, 1882.
Bithynis acanthurus Rathbun, Proc. U. S. Nat. Mus., XXII, No. 1199, p. 315, 1900.

Rostrum a little variable, rectilinear or slightly curved upward, as long as or longer than antennal scales and longer than stalk of inner antennæ; it has 8 to 12 teeth above and 4 to 7 below. Second pair of feet almost cylindrical, equally developed, spiny in the old and rough in the young; carpus considerably longer than merus; palm cylindrical; fingers shorter or just as long as palm, in the old like felt; spines strong, arranged in longitudinal series. Telson short-pointed, inner of side teeth overreaching extremity.

Length of body, 102 mm.; length of large cheliped, 116.5 mm.

Known from Rio Grande, Texas; Antilles; Escondido River, Nicaragua; Sabanilla, United States of Colombia (*Albatross*); Brazil, as far south as Rio Grande do Sul; Panama; Ecuador; West Africa. Porto Rican localities: Rio Bayamon; San Juan market; Rio Bayamon, above Palo Seco; Aguadilla; Mayaguez, in fresh water; Ponce; Isabel II Vieques Island; Fajardo; Rio Arecibo (Gundlach).

Common name, *Ñoca* (Gundlach).

Bithynis olfersii (Wiegmann).

Palæmon olfersii Wiegmann, Arch. f. Natur., II, pt. 1, 150, 1836; Ortmann, Zool. Jahrb., Syst., V, 733, pl. XLVII, f. 8, 1891.
Palemon spinimanus Milne Edwards, Hist. Nat. Crust., II, 399, 1837.
Palæmon spinimanus von Martens, Arch. f. Natur., XXXV, pt. 1, 26, pl. II, f. 3, 1869.
Palæmon faustinus Saussure, Mém. Soc. Phys. Hist. Nat. Genève, XIV, 469 (53), pl. IV, f. 30, 1858; Ortmann, Zool. Jahrb., Syst., V, 734, 1891; Rev. Mus. Paulista, II, 213, 1897.
Palæmon olfersi Ortmann, Rev. Mus. Paulista, II, 212, pl. I, figs. 10 and 11, 1897.

Rostrum as long as or a little shorter than the stalk of inner antennæ, shorter than antennal scale, arched above; 13 to 14 teeth above, 3 to 5 below. Chelipeds of second pair very unequal. Carpus longer or shorter than merus; carpus and merus distally swollen. Palm strongly compressed, oval or oblong-oval, broader than carpus and longer than broad. Fingers widely gaping when flexed; movable finger curved. Chelipeds armed with spines, which are stronger and slightly curved on the side of flexion of segments. Inner, outer, and lower surfaces of palm covered with felt and with long hair. Telson pointed, inner of side spines longer than the point. In the National Museum are all gradations between the two forms hitherto known as *olfersii* and *faustinus*. In specimens from Costa Rica, the chelipeds are very broad, palm a very little longer than broad, carpus much swollen and as long as width of palm, merus much swollen at middle and 1.5 times as long as carpus. This is the most extreme form of *olfersii*. Specimens from La Paz have the cheliped similar to that figured by Ortmann (Rev. Mus. Paulista, II, pl. I, f. 10)—the palm nearly twice as long as broad, the carpus about two-thirds as long as the palm and subequal to the merus. A specimen from Jamaica represents the most slender form of the *faustinus* variety. The palm is 2.5 times as long as broad, the carpus a little longer than palm and 1.33 times as long as merus. Porto Rican specimens from Rio Caguitas resemble strongly Saussure's figure of *faustinus*. The rostrum, however, does not quite reach the extremity of the antennal peduncle. The following shows the dimensions of a number of specimens:

Locality.	Sex.	Length of body.	Length of propodus of larger cheliped.	Length of palm of larger cheliped (outer margin).	Width of palm (without spines).	Length of carpus.	Width of carpus.	Length of merus.	Width of merus.
		mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
Costa Rica	Male	51	23	11.2	9	9	5.7	12.5	6
La Paz	do	45	22.5	13.3	7.2	9.5	4.3	9.7	4
Cape St. Lucas	do	49.3	19	9.6	5.2	8.9	4.2	9	3.6
Guadeloupe	do	88.5	44.5	24.3	13.5	20	8.6	22.3	9
Porto Rico (Rio Caguitas)	do	71	44.2	25	12	22.6	8	18.2	8
Jamaica	do	71.5	43	22	8.7	22	6.2	17	5.8

Porto Rico; Rio Caguitas, Caguas; Rio Grande, near mouth of Rio Caguitas; Rio Bayamon; Mayaguez, fresh water; Arroyo; Fajardo; in the rivers about Bayamon (Gundlach).

Also at Jamaica (*Albatross*); Haiti (Saussure, Ortmann); Cuba (von Martens, Gibbes); Santo Domingo (W. M. Gabb, coll.); Dominica (Pocock); Tobago (F. A. Ober, coll.); Port Castries, St. Lucia, in small brook (*Albatross*); Guadeloupe (Mus. L. Guesde); Vera Cruz, Mexico (Ortmann); Escondido River, Nicaragua, 50 miles from Bluefields (C. W. Richmond, coll.); La Guaira, Venezuela (Lieut. Wirt Robinson, U. S. A., coll.); Rio de Janeiro (von Martens); near Rio de Janeiro (Ortmann); La Paz; Cape St. Lucas; Costa Rica; West Africa.

Common name, *Ñoca* (Gundlach).

Bithynis savignyi (Bate).

Brachycarpus savignyi Bate, Challenger Rept., Zool., XXIV, 795, pl. CXXIX, f. 4, 1888.

Rostrum horizontal, reaching end of antennal scale; armed with 7 teeth above (3 of which are on carapace) and 3 below. Feet of second pair subequal, almost cylindrical, smooth, fingers hairy;

carpus less than half the length of merus, distally thickened; palm subcylindrical, slightly compressed, not much thicker than carpus; fingers more than half the length of palm. Dactyli of last three pairs of feet biunguiculate. Telson short, pointed, on either side with two movable spines, of which the inner overreaches the middle point. Length, 44 mm.; length of second cheliped, 41 mm.

A marine species, taken at Ponce; Light-House Reef, Arroyo; Ensenada Honda, Culebra.

Bermudas, shallow water (Bate); Nassau (Rankin); off Habana, Cuba, 78 fathoms, station 2169 (*Albatross*); between Jamaica and Haiti, 23 fathoms, station 2138 (*Albatross*); Curaçao (*Albatross*).

Genus PALÆMON Fabricius.

Palæmon Fabricius, Suppl. Entom. Syst., 378, 1798.
Leander Desmarest, Ann. Soc. Entom. France (2), VII, 87, 1849; Stimpson, Proc. Acad. Nat. Sci. Phila., XII, 40 (109), 1860.

Much like *Bithynis*, but carapace armed with an antennal and a branchiostegal spine; no hepatic spine. Legs of second pair not so greatly developed as in *Bithynis*. Species for the most part marine and of small size.

Key to the Porto Rican species of the genus Palæmon.

A. Rostrum with 8 or 9 teeth on upper margin, 3 or 4 on lower margin. Antennal scale very broad, its spine not reaching end of blade .... *affinis*
A′. Rostrum with 11 to 13 teeth on upper margin, 5 to 7 on lower margin. Antennal scale very narrow, its spine overreaching blade .... *paulensis*

Palæmon affinis Milne Edwards.

Palemon affinis Milne Edwards, Hist. Nat. Crust., II, 391, 1837.
Palæmon affinis Dana, Crust. U. S. Expl. Exped., I, 584, 1852; pl. XXXVIII, f. 5, 1855. Bate, *Challenger* Rept. Zool., XXIV, 782, pl. CXXVIII, f. 5, 1888.

Dorsal crest beginning at middle of carapace, either horizontal or slightly depressed at middle of rostrum and ascending toward extremity, reaching to or beyond end of antennal scale; armed with 8 or 9 teeth, 2 or 3 of which are on the carapace; the last tooth usually near tip of rostrum and separated by a considerable distance from penultimate tooth; lower margin of rostrum with 3 or 4 teeth. Adult Porto Rican specimens are smaller than those from New Zealand before me, and have 8 to 10 segments of upper flagellum of antennula united and 12 to 16 free; whereas the New Zealand specimens have 12 to 14 united and 20 to 25 free. Carapace of second pair of feet reaching to or beyond the tip of the rostrum; slightly longer than the palm. Palm 1.5 times as long as the fingers, not swollen, a little wider than distal end of carpus.

Length of ovigerous female from Fajardo, Porto Rico, 35.5 mm.; length of carapace and rostrum, 16.1 mm.; length of rostrum, 8.5 mm.

Porto Rico; Puerto Real; Boqueron Bay; Arroyo; Hucares; Fajardo.

New Zealand (Milne Edwards, Dana, U. S. Nat. Mus.); Port Jackson, Australia (Bate); Bermudas (Heilprin, Ortmann).

The rostrum of the New Zealand specimens in the National Museum is almost horizontal, but in Porto Rican specimens it resembles Bate's figure of an adult female of approximate size. Specimens of *Palæmon squilla* from Jersey in the National Museum have the palm twice as long as the fingers.

Palæmon paulensis (Ortmann).

Leander paulensis Ortmann, Revista Mus. Paulista, II, 192, pl. I, f. 14, 1897.

Dorsal crest beginning just in front of middle of carapace, armed with 11 to 13 teeth, the first 2 or 3 of which are on the carapace itself; rostrum ascending for its distal two-thirds; lower margin with 5 to 7 teeth; as long as or a little longer than antennal scales. The antennular peduncle reaches a little more than half the length of antennal scale. The outer flagellum has in the type specimens 8 segments united and 12 free; in specimens in hand 5 to 7 segments are united and 15 to 17 free. Antennal scale very narrow, its inner margin very oblique; antero-external spine extending beyond blade. Middle of palm of second pair of feet opposite tip of rostrum. Carpus, palm, and fingers subequal in length; the carpus may be a little longer than the palm. The carpus increases in size distally; the palm is subcylindrical, slightly compressed and swollen, wider than carpus.

Length of ovigerous female from Marco, Fla., 28.5 mm.

Specimens which I refer to this species are from Marco and Punta Rassa, Fla. Some of them had been recorded by Kingsley as *Palæmonetes carolinus*. They differ from Ortmann's description and figure in having the posterior two of the dorsal teeth more separated than the others.

One specimen only was taken in Porto Rico, at Mayaguez, with the boat dredge; it agrees in all respects with the Floridian specimens, except that the rostrum is only two-thirds as long, having the appearance of abnormality.

Type locality, Brazil, between the continent and the island of San Sebastian, State of San Paulo.

The Floridian and Porto Rican form may prove to be distinct from the Brazilian, but a comparison of specimens is necessary to determine this point.

Genus UROCARIS Stimpson.

Urocaris Stimpson, Proc. Acad. Nat. Sci. Phila., XII, 39 (108), 1860.

Body slender, compressed; abdomen long, sixth segment especially elongate. Rostrum above cristate, dentate; below straight, toothless except near tip. Hepatic spine present. Eye-stalks long. Antennulæ similar to those of *Bithynis*. Mandibles not palpigerous. External maxillipeds and feet agreeing with those of *Bithynis*.

Urocaris longicaudata Stimpson.

Urocaris longicaudata Stimpson, Proc. Acad. Nat. Sci. Phila., XII, 39 (108), 1860.

Rostrum short, not reaching end of penult segment of antennular peduncle; superior crest strongly dilated above eyes, arcuate, seven to eight-toothed; lower margin with a tooth near tip. A long rounded extra-orbital tooth. Antennal scale longer than antennular peduncle. First pair of feet slender, reaching to tip of spine on antennal scale; carpus and propodus equal. Second pair a little stouter, middle of carpus reaching tip of antennal scale; carpus, palm, and fingers subequal. Last three pairs of feet very slender; dactyli biunguiculate. Abdomen four or five times as long as carapace, third segment strongly swollen, sixth segment slender, as long as carapace.

Length, 21 mm.; length of carapace and rostrum, 5.6 mm.; of rostrum, 2.5 mm.

Mayaguez, 1 specimen; off Culebra, 14¾ fathoms, station 6086, 1 specimen.

Carolina (Stimpson); Beaufort, N. C. (Kingsley); Marco Pass and Charlotte Harbor, Fla. (Kingsley); Andros Bank, Bahamas (F. Stearns, coll.); Punta Rassa, Fla., 1 fathom (H. Hemphill, coll.); Sarasota Bay, Fla., one-half fathom (H. Hemphill, coll.); Marco, Fla., one-third fathom, among sponges (H. Hemphill, coll.); Marco (*Grampus*); Gulf of Mexico, 30 fathoms, station 2405 (*Albatross*); Jamaica (*Albatross*); off Cape Catoche, Yucatan, 24 fathoms, station 2365 (*Albatross*); off Jacumã, Parahyba, Brazil, 15 feet (Branner-Agassiz Exped., 1899).

Family GNATHOPHYLLIDÆ Kingsley, (Gnathophyllinæ) 1879; Ortmann, 1890.

Rostrum short, compressed, toothed. Mandibles without a cutting edge and without palp. Third segment of outer maxilliped strikingly broad; both the following segments are small. First two pairs of feet chelate, the first pair feeble, the second strong. Contains only one genus:

Genus GNATHOPHYLLUM Latreille.

Gnathophyllum Latreille, Nouv. Dict. Hist. Nat., 2d ed., XXX, 72, 1819 (*Gnatophyllum*); Cuvier's Règne Anim., 2d ed., IV, 96, 1829.

Drimo Risso, Hist. Nat. Eur. Mérid., V, 70, 1829.

Gnathophyllum americanum Guerin.

Gnathophyllum americanum Guérin, in La Sagra's Hist. Cuba, VII, p. XX, 1857; atlas, VIII, pl. II, f. 14.

Gnathophyllum fasciolatum Stimpson, Proc. Acad. Nat. Sci. Phila., XII, 28 (97), 1860; Haswell, Cat. Austral. Crust., 181, 1882.

Gnathophyllum zebra Richters, Meeresfauna Mauritius u. d. Seychellen, 161, pl. XVII, figs. 18–20 and 22, 1880.

? *Gnathophyllum pallidum* Ortmann, Zool. Jahrb., Syst., V, 537, 1890.

Body thick. Carapace obtusely carinate dorsally, carina obsolete posteriorly, and anteriorly continuous with rostrum. Rostrum not reaching apex of antepenultimate segment of antennular peduncles, obliquely truncate above, a little concave, and five to six-toothed, the extremity acute, the lateral carinæ situated near inferior margin, which has a very small tooth near tip. Eyes rather large, having a prominent, conical, obtuse protuberance, pigmented with black, arising from upper part of cornea. Caudal segment armed with two marginal spines toward extremity and two long spines at extremity. Body marked with ten to sixteen linear transverse bands of color; legs with a band of same color on ischial, meral, and propodal joints. Specimens which have been long in alcohol show no stripes.

Length, about 11 mm.

Boqueron Bay; Playa de Ponce; Arroyo. Port Jackson, Australia (Stimpson); Port Stephens, Australia (Haswell); Fouquets, Mauritius (Richters); Tahiti (Ortmann); Cuba (Guérin); St. Thomas, West Indies (*Albatross*); Gulf of Mexico, 26 to 27 fathoms, stations 2372, 2374 (*Albatross*); Bermudas (G. B. Goode, coll.).

Family PASIPHÆIDÆ Kingsley, 1878.

Rostrum small or obsolete; mandibular palp two or one-jointed or wanting. Trunk-legs with exopods. Third, fourth, and fifth pairs inferior in size to the two pairs of chelipeds, the fourth being generally smallest of all.

LEPTOCHELA Stimpson, 1860.

Leptochela Stimpson, Proc. Acad. Nat. Sci. Phila., XII, 42 (111), 1860.

Carapace partially cristate; lateral walls and margin destitute of spines. First pair of antennæ biflagellate. Mandibles with a short one-jointed palp. Second maxillipeds not pediform, the last joint armed with long spines or hairs. First and second pairs of feet compressed, chelate, slender, with long parallel digits. Three posterior pairs short. Pleon with the fifth segment more or less abruptly curved. Telson long, narrow, and tapering.

Key to the Porto Rican species of the genus Leptochela.

A. Orbits entire. Carina of fifth abdominal segment dentate .... *carinata*
A'. Orbits serrate or spinulous. Carina of fifth abdominal segment entire.. *serratorbita*

Leptochela carinata Ortmann.

Leptochela carinata Ortmann, Dec. u. Schiz. Plankton Exped., 41, pl. IV, f. 1, 1893.

Anterior portion of carapace with a median crest extending to point of rostrum; in females this crest extends the length of the carapace, and there is also a sharp lateral crest, slightly curved, but subparallel to median, and not far from it, and reaching from orbit nearly to posterior margin. In the males the median carina is on anterior half only, and there is only a faint indication of the lateral carinæ. Rostrum shorter than eye-stalks, deflexed. Orbits entire. Antennular peduncles reaching to middle of antennal scale. Fingers of first and second pair of feet about as long as or a little longer than palm; palm 1.5 times as long as carpus. Fourth abdominal segment carinated in its posterior half; fifth segment carinated throughout its length, the carina cut into four triangular teeth; sixth segment with a median spine or tubercle at its anterior extremity. Telson with an anterior submedian pair of spinules and three lateral marginal pairs, equidistant, the first pair opposite the submedian pair, the second pair at middle of margin, and third pair at extremity.

Length of egg-bearing female, west Florida, 28 mm.; length of carapace and rostrum, 7.8 mm.

Off Vieques, 6 to 14 fathoms, stations 6084, 6085, 6096, 3 specimens; off Culebra, 15 fathoms, station 6093, 1 specimen. Off mouth of Tocantins, Brazil, depth 50 to 100 meters (type locality); Rum Cay, Bahamas (*Albatross*); Gulf of Mexico, 19 fathoms, station 5084 (schooner *Grampus*).

Leptochela serratorbita Bate.

Leptochela serratorbita Bate, Challenger Rept., Zool., XXIV, 859, pl. CXXXIX, f. 1, 1888.

Abdomen more than 2.75 times as long as the carapace. Anterior half of the carapace carinated; rostrum almost horizontal, as long as or longer than the eye-stalks, orbits finely serrated or spinulous, antennal scale shorter than in *carinata*, the antennular peduncle reaching beyond middle of scale. Fingers of both first and second pairs of feet a little longer than palm, which is only a trifle longer than carpus. Fourth and fifth segments of abdomen carinated, entire; sixth segment with an anterior median tubercle, and a posterior spine either side of middle. Telson with an anterior submedian pair of spines and three lateral marginal pairs, of which the anterior pair is at the anterior fourth, the second pair at the middle, the third pair near posterior extremity.

Length of female, Key West, 18 mm.; length of carapace and rostrum, 4.7 mm.

Off Vieques, 15 fathoms, station 6091, 1 specimen; off Culebra, 15 fathoms, station 6093, 4 specimens. St. Thomas, W. I., shallow water (type locality); St. Thomas (*Albatross*); Key West, taken at surface by electric light (*Albatross*).

THE ANOMURAN COLLECTIONS MADE BY THE FISH HAWK EXPEDITION TO PORTO RICO.

BY

JAMES E. BENEDICT,

Assistant Curator of Marine Invertebrates, U. S. National Museum.

THE ANOMURAN COLLECTIONS MADE BY THE FISH HAWK EXPEDITION TO PORTO RICO.

By JAMES E. BENEDICT,
Assistant Curator of Marine Invertebrates, U. S. National Museum.

In classification the Anomuran crabs occupy a shadowy place between the Brachyura and the Macrura. In some systematic works in recent years the Anomura have been divided between these subdivisions under the names *Brachyura anomalia* and *Macrura anomalia*. This does not, however, change the group from its intermediate position, nor, indeed, do more than indicate the value of its characters in the mind of an author.

The Anomura are found in all seas, though the distribution is by no means even, by far the larger number being found in the tropical and subtropical belts. The family *Lithodidæ* is most numerously represented in the North Pacific Ocean. The hermit crabs are the best-known members of the Anomuran group; common in all latitudes, usually from the shore line to considerable depths, they present the variations of form that a world-wide distribution naturally gives. The soft and unprotected abdomen compels them to find something with which to cover it, and we find them in shells and sponges or overgrown with polyzoa or anemones. The great majority live in the dead shells of mollusks, changing from one shell to another as they grow or when for any reason they have occasion to seek another house.

The necessity of changing shells as the crab grows is done away with in a curious manner in the case of some species. A hydroid envelops the shell and grows with the crab, or a sea anemone plants itself on the shell and covers it on all sides except the mouth, growing in the form which will furnish the best protection. In return for this kindly act the crab furnishes motive power for an otherwise stationary animal. One thing leads to another, and we often find the sea anemone and crab in close contact; the shell having, as it were, fitted the anemone to the crab, had lost its usefulness and been dissolved by one or the other of its captors. In the North Pacific the *Albatross* dredged many hermits living in sponges, the size of the sponge being disproportionately great to that of the crab. Here also the original home of the crab was in a shell, the shell in time being overgrown with a sponge.

When the hermits move about they protrude their chelipeds or hands and the first two pairs of ambulatory feet; the posterior two pairs are very much reduced in size; their function as ambulatory feet is a thing of the past. In the Anomura the fifth pair are always more or less modified; in some the fourth pair are equally so, as in the hermits. The Dromias have the fourth and fifth pairs reduced in size and furnished with a small hook-like nail. By means of these modifications they are able to hold sponges or shells over their backs. In the *Porcellanidæ* the fifth pair are small and elevated so that they rest on the carapace. In the *Lithodidæ*, or Anomuran spider crabs, the fifth pair are very small and are folded under the carapace, so that this family presents to the eye but four pairs of legs, a character which easily distinguishes it from any other family of Decapods.

The Anomuran collection made by the Fish Commission expedition to Porto Rico in the winter of 1898–99, on the steamer *Fish Hawk*, contains 9 species believed to be new, a total of 53 species being described. The most interesting feature of the collection is the number of new species of hermit crabs of the genus *Paguristes* and that group of the genus to which *Paguristes depressus* belongs. Stimpson described this species in 1859, from specimens dredged by Dr. Gill at St. Thomas. A. Milne-Edwards and Bouvier described 6 species from the *Blake* dredgings, and here 5 additional species are now presented as new. Most of them live in shells with rather narrow openings and show the modifications described by Stimpson, which result from narrow quarters. It is true of these species, as well as of *P. depressus*, that they have "all of the generic peculiarities of *Paguristes*."

In this report it was thought best not to confine the descriptions to the species actually taken by the expedition, but to add descriptions of the more common species which are not in this or other Porto Rican collections, yet are likely to occur there.

Figures of many species of Anomura of the West Indian region are inaccessible or altogether lacking. While this lack has not been supplied, a beginning has been made, 26 species being here figured.

All of the figures were drawn by Miss Annie A. McKnew, except figs. 2 and 3, plate 5.

Genus DROMIA.

Dromia erythropus (G. Edwards).

Cancer marinus chelis rubris Catesby, Nat. Hist. Carolina, Florida, and the Bahama Islands, II, 37, pl. XXXVII, 1743.

Cancer erythropus Edwards, Catalogue of Animals in Catesby's Natural Hist. of Carolina, with the Linnæan names, 1771. (*Teste* M. J. Rathbun.)

Dromia lator H. M. Edwards, Hist. Nat. des Crust., II, 174, 1837.

Dromia erythropus M. J. Rathbun, Annals of the Institute of Jamaica, vol. I, No. 1, p. 39, 1897.

The front is tridentate, the inner angles of the orbits forming two and the rostral point the third, which is about as far below the line of the orbital angles as they are separated from each other. There are five teeth on the antero-lateral margin, including the one at the outer angle of the eye. The carapace is very convex in all directions, much broader than long; it is covered with a coat of short bristles, which altogether conceal the substance of the shell. The chelipeds are similarly covered, only the tips of the fingers being exposed. The chelipeds and the first and second pairs of ambulatory feet are stout and strong, folding in close to the body; the fourth pair are the shortest; the fifth pair rest on the posterior portion of the carapace. Both the fourth and fifth are much flattened and are subchelate.

This crab is found in shallow water throughout the West Indian region. The carapace of one at hand measures 67 mm. in length and 84 in breadth.

Genus DROMIDIA.

Dromidia antillensis Stimpson.

Dromidia antillensis Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, p. 71, March, 1859.

The front of this species is very much as in *Dromia erythropus*. The carapace is longer than wide; teeth of the antero-lateral margin are little more than enlarged granules, with the exception of the one behind the cervical suture. The outer angle of the eye is produced, but is not tooth-like. The fourth and fifth pairs of feet are subchelate. Carapace and feet are covered with a dense coat of short bristles, only the tips of the fingers showing. This crab carries over its carapace a growing sponge, with a cavity beneath into which the carapace fits. Under these conditions sponges are sometimes seen to move about, to the astonishment of those unacquainted with this bit of natural history.

Porto Rico. Collected by Mr. G. M. Gray. Mayaguez, station 6093.

Genus HYPOCONCHA.

Hypococha sabulosa (Herbst).

Cancer sabulosa Herbst, II, p. 57, pl. 48, figs. 2 and 3, 1799.
Hypoconcha sabulosa Guérin, Rev. et Mag. Zool. (2), VI, p. 333, pl. 5, 1854. Stimpson, Proc. Acad. Nat. Sci. Phila. 1858, p. 226; also Ann. Lyc. Nat. Hist. N. Y., VII, p. 72, March, 1859.

This and the following species are very much alike and have similar habits. The front and lateral margins are expanded, covering the eyes and all parts of the head except the flagella of the antennæ; the middle surface is very thin and membranous. There is but little hair on the surface of the specimens examined; the margin is heavily fringed with bristles and armed with a number of white spines. In outline this species is a little flattened in front and there is a large notch on the median line; there are no notches over the antennæ; the sides are a little flattened, but are not concave as in Herbst's figure. The fourth and fifth pairs of feet are prehensile without being subchelate as in *Dromia*. The shape of this crab has, like that of the hermit crabs, been modified to suit its dwelling or protective covering, for it holds over its carapace the valve of some lamellibranch, holding on by some of its posterior feet and perhaps, as Dr. Stimpson suggested, by the angular abdomen inserted under the hinge.

Herbst's specimens were from Africa, while the other writers have all had them from the West Indian region, and it is not unlikely that the African species may prove to be the true *sabulosa* and that the species in hand may differ more from that than from *H. arcuata*.

Length of an individual, 11.5 mm.

Hypoconcha arcuata Stimpson.

Hypoconcha arcuata Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, p. 72, March, 1859.

In comparison with *H. sabulosa* this species is more evenly rounded in front and on the sides; there is a deep fissure on the middle of the front rather than a notch; there are slight notches above the antennæ; the white spines that arm the border are smaller and more numerous.

Length, 115 mm.; width, 11.8 mm.

Genus PETROLISTHES.

Petrolisthes sexspinosus (Gibbes).

Porcellana sexspinosa Gibbes, Proc. Amer. Assoc. for Adv. of Science, III, 1850, p. 190.
Petrolisthes sexspinosus Stimpson, Proc. Acad. Nat. Sci. Phila. 1858, p. 227. Kingsley, Proc. Acad. Nat. Sci. Phila. 1879, p. 405.

The front is produced, triangular. The carapace is crossed by numerous rugose and ciliated lines; similar lines cross the chelipeds diagonally. Four large triangular, spine-pointed teeth arm the inner margin of the carpus.

Many specimens of this species were taken at Ensenada Honda, Culebra; some agree well with specimens from Florida, others have a row of four or five spines on the movable finger of the hand. At first the spiny-fingered variety seemed to be specifically distinct, as the color was different; afterwards the spines were found on specimens of all varieties of color. The larger and more numerous specimens are purple and white, the ridges taking the color while the intermediate spaces are occupied by the cilia, which under a lens become white plumes. In another variety the purple is changed to red, and in these there is likely to be a double cross on the carapace, caused by a line or light streak running from the rostrum to the posterior margin, and two transverse lines, one between the eyes and one near the center; specimens with this color are more likely to have the spiny fingers than the larger purple and white ones.

Common throughout the West Indies and southern coast of the United States; Porto Rico, at San Juan, Boqueron, Ensenada Honda (Culebra), Mayaguez Harbor, Caballo Blanco Reef, and other localities; stations 6075 and 6065. Length, 7.5 mm.; width, 6.5 mm.

Petrolisthes armatus (Gibbes).

Porcellana armata Gibbes, Proc. Amer. Assoc. for Advancement of Science, III, 1850, p. 190.
Porcellana gundlachii Guérin, in La Sagra's Hist. of Cuba, VIII (Atlas), 1855, Articulata, pl. II, fig. 6.
Petrolisthes armatus Stimpson, Proc. Acad. Nat. Sci. Phila. 1858, p. 227. Kingsley, Proc. Acad. Nat. Sci. Phila. 1879, p. 406.

The front is obtuse and but little produced. The carapace is crossed by numerous broken lines of minute ridges. The chelipeds are long; the carpus has three equidistant teeth on inner margin and four or five curved teeth on outer margin. The hand has a line of spinules on the lower margin; in some specimens the spinules are wanting; surface of hand roughened by short lines of granules.

San Juan and Boqueron Bay. Length, 9.5 mm.; width, 9 mm.

Petrolisthes tridentatus Stimpson. Plate 3, fig. 2.

Petrolisthes tridentatus Stimpson, Annals Lyc. Nat. Hist. New York, VII, March, 1859, p. 75, pl. I, fig. 4.

The rostral lobe of the front is broad and triangular, the lateral lobes or teeth are well separated from the median lobe and markedly divergent. The chelipeds are large, glabrous to the eye, minutely rugose under a lens. There are no teeth or spines anywhere, with the exception of a rounded tooth on the inner distal angle of the merus and a small sharp, curved spine on distal angle of carpus. The inner margin of carpus is thin and slightly produced; outer margin marked with enlarged rugæ.

P. tridentatus has been taken at St. Thomas, Barbadoes (types), and Trinidad.

Petrolisthes marginatus Stimpson. Plate 3, fig. 1.

Petrolisthes marginatus Stimpson, Annals of the Lyceum of Nat. Hist. of New York, VII, 1859, p. 74.

The outline of the front from the median lobe to the angle of the orbit is straight; the median lobe is rounded and deflexed. The carapace is pubescent, The chelipeds are not so slender as in *P. armatus;* there are four sharp teeth on the inner margin of the carpus; in the center is a row of small round tubercles; a row of more flattened tubercles arm the outer margin. A ridge runs from the gape of the fingers to the anterior angle of the carpus; the lower margin of the hand is armed with spinules. The color of the specimen when it first reached the Museum was pink. Stimpson gives the color as "a deep purplish crimson." The ambulatory feet were lost from the single specimen. Taken at Ponce.

Petrolisthes quadratus, new species. Plate 3, fig. 4.

The front is thin, produced to an angle in the middle. A deep depression reaches the apex from between the protuberances of the gastric region; the orbits are raised and a depression extends to the inner angle of the orbit from a point at the side of the gastric protuberances. There is a small protuberance on the gastric region behind the eye. There is only a slight emargination of the carapace where the cervical groove meets the side. The sides of the carapace are parallel; near the margin there are rugose lines, becoming coarser on the shoulder. The meral segments of the ambulatory feet are rugose; there are no spines anywhere except under the dactyl. The right cheliped is wanting; the left is large and strongly granulated. There are two slight longitudinal depressions and three resulting ridges on the carpus; the marginal granules are a little enlarged. There is a sulcus on the movable finger and a slight one near the crest of the palm. The fingers are pubescent on the inner surface near the prehensile edges. There are no spines or teeth on the chelipeds.

Reefs at Ponce. One specimen. Length of carapace, 5 mm.; width, 5.5 mm.

Petrolisthes nodosus Streets.

Petrolisthes nodosus Streets, Proc. Acad. Nat. Sci. Phila., XXIV, p. 133, 1872.

The following is from the original description: "The carapace is broadly ovate, about as broad as long. The anterior portion is nodulated; the nodules are arranged in a semicircular manner transversely across the dorsum from one hepatic region to the other. The posterior portion of the carapace is distinctly imbricated. The front is prominent and deeply tridentate; the middle tooth is the largest and triangular in shape and very slightly more prominent than the lateral ones. The carpus is shorter than the hand. The anterior margin is armed with four large, serrated, and imbricated teeth; the two middle ones are the largest and are united at their bases; the external tooth is smallest."

Petrolisthes jugosus Streets.

Petrolisthes jugosus Streets, Proc. Acad. Nat. Sci. Phila. 1872, p. 134. Kingsley, Proc. Acad. Nat. Sci. Phila. 1879, p. 405.

The carapace is about as broad as long; the front is evenly convex from orbit to orbit when seen from above; in front it shows a V-shaped depression on the median line. The cervical groove is strongly marked; there is a paired tubercle on the side of the gastric region formed in part by a depression between this point and the raised margin of the orbit. The chelipeds are rather short for the genus; the carpus has a U-shaped sulcus on its upper surface; the opening of the U is on the proximal end; the ridge within the U and the ridges on each side are crossed diagonally by numerous raised lines; the anterior margin is armed with four teeth graded in size, the largest being on the proximal end. The hand is roughened with rather coarse granules; the lower margin is carinate.

The collection contains several specimens which I refer to this species; they are specifically identical with Mr. Kingsley's specimen from Key West, with which they have been compared. The Museum collection contains a number from St. Thomas. The Porto Rico expedition obtained several specimens at Caballo Blanco Reef and at Ponce.

Petrolisthes ? amœnus (Guérin). Plate 3, fig. 3.

Porcellana amœna Guérin, in La Sagra's History of Cuba, VIII, Atlas, pl. II, fig. 2, "1855."

The front is in the form of an obtuse angle; it has a deep depression from the apex along the median line to a line which curves from the slight protuberances of the gastric region to the shoulder where the cervical suture begins; the sides of the front are denticulated; there is a spine on the orbit and one at the shoulder. The carapace is without rugæ; a lens discloses a slight pubescence over the entire surface but becoming a little more marked near the front; it is longer than broad, measuring from the apex of the rostral projection; the areolations are very indistinct. The left cheliped is wanting, the right is smooth to the eye; the hand is granulose under a lens, the carpus is minutely rugose. The carpus is armed with four teeth on the inner margin very much like those of ***P. sexspinosus***; it also has a row of four or five much smaller ones on the outer margin. The hand is marked by a row of spines on the lower margin of the palm, by a carina on its crest, and by a sulcus which runs the length of the finger. The dactyls of the ambulatory feet are spiny below and the merus has a line of four or five spines above. This species is readily distinguished from ***P. sexspinosus*** by the lack of coarse rugæ on the carapace and chelipeds.

A single specimen from the reefs at Ponce, Porto Rico. Its identification with La Sagra's specimens from Cuba is by no means complete, but the general characters are there. Guérin's figure would indicate that *P. amœnus* was much like *P. sexspinosus* in color.

Genus PISOSOMA.

Pisosoma glabra Kingsley. Plate 3, fig. 5.

Pisosoma glabra Kingsley, Proc. Acad. Nat. Sci. Phila., p. 406, pl. XIV, fig. 2, 1879.

The front is broad, slightly emarginate; the middle is a little in advance of the inner angles of the orbits. In general, the surface of the carapace is smooth, though slightly rugose near the posterior angles. The chelipeds are short and stout, subequal. When the hand is drawn back under the thin inner edge of the carpus, a large tooth-like projection nearly reaches the line of the inner base of the dactyl and the carpus. The margin is further divided up by three other toothlike lobes; a line drawn from the ends of the lobes at the extremes of the margin shows the middle lobes in advance; the outer margin is armed with a line of sharp granules; parallel to this is another line of like granules, but smaller in size and shorter in length of line. The hand is more triangular than in *P. angustifrons* or *P. serrata*.

There was but one specimen in the Porto Rico collection. This agrees well with the type from which the figure was made. The exact locality is not given on the label.

Pisosoma angustifrons, new species. Plate 3, fig. 6.

This species is much like *P. greeleyi* Rathbun.[1] It differs in having a rougher carapace; the sides are less arcuate. The right cheliped is stout and larger than the left. The carpus has numerous large and well separated granules evenly distributed on its upper surface; the granules on the carpus of *P. greeleyi* are crowded on the outer margin. The inner margins of the carpus in *P. angustifrons* is armed with four blunt teeth, one of which has a double point, otherwise the teeth are even in size and similar in shape. *P. greeleyi* has but three granulated teeth, uneven in size. The hand of the latter is granulated; the granules are not arranged in rows; in *P. angustifrons* there are two prominent rows of granules on the palm.

One specimen from Trinidad in the *Albatross* collection.

Pisosoma serrata, new species. Plate 3, fig. 7.

The front is a little advanced in the middle, otherwise it is rectangular in appearance. The orbits are deeper than in *P. angustifrons*. The carapace is convex in both directions and is rugose near the lateral and posterior margins. The branchial and other depressions are slight. The chelipeds are stout and unequal. The thin inner margin of the carpus is incised; three notches divide it into teeth, which are again divided into two or more points; the surface near the margin is set with large, rounded granules, while the surface near the opposite margin is set with ridges and compressed granules, which appear like little disks on edge. The granules of the middle of the carpus are very much depressed. The surface of the palm is thickly set with coarse granules; near the crest the granules are smaller. The elevated portion of the crest is longer than in *P. glabra* and about the same as in *P. angustifrons*.

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[1] Proc. Wash. Acad. Sci., II, p. 147, pl. VIII, fig. 4, 1900.

On corals at Mayaguez.

This species, like all others of the genus that I have seen, is small, the larger specimens not measuring more than 5 mm. in width.

Genus PACHYCHELES.

Pachycheles rugimanus A. Milne-Edwards. Plate 3, fig. 9.

Pachycheles rugimanus A. Milne-Edwards, Bull. Mus. Comp. Zool., VIII, p. 36, 1880–81.

The outline of the frontal margin as seen from above is nearly straight; from in front the margin dips down in a V at the median line. The orbits are raised, forming a depression behind the margin. The chelipeds are subequal; the inner margins of the carpal segments are armed with four teeth, graded in size, the proximal being the largest; the upper surfaces have four longitudinal ridges, with deep channels between; the channels are interrupted at the bottom by septæ, which form a row of oblong pits between the ridges. The hands have the same general character, except that there is less regularity in the arrangement. The dactyls of the ambulatory feet are short and are armed beneath with three or more small spines, too small to warrant the term multiungulate.

Dredged by the *Blake*.

Pachycheles ackleianus A. Milne-Edwards.

Pachycheles ackleianus A. Milne-Edwards, Bull. Mus. Comp. Zool., VIII, p. 36, 1880–81.

The front is nearly vertical and straight as seen from above; from before the median projection it is short and triangular. The carapace is longer than wide, with nearly parallel sides; a prominent suture crosses it from side to side, running behind the hepatic and gastric regions. The chelipeds are very unequal in size; the left is much the larger in one specimen, while the reverse is true in two others. The carpal segment of each is armed with three stout teeth on the inner margin. The surfaces are dotted with large flattened granules, without any regular arrangement; the granules on the hand are similar, except on the lower margin, where they are regularly elongated and are arranged in rows; a bunch of granules near the gape of the fingers forms a prominent tubercle. The dactyls are short, wide, and multiungulate, as in *Polyonyx* Stimpson, and like the type species of that genus it is commensal in its habits, having been found by Mr. J. E. Duerden "in massive black sponges." In appearance and in the character of the antennæ it is a *Pachycheles*.

U. S. Fish Commission steamer *Albatross*, station 2413.

Genus MEGALOBRACHIUM.

Megalobrachium poeyi (Guérin). Plate 3, fig. 8.

Porcellana poeyi Guérin, La Sagra's Hist. of Cuba, VIII (Atlas), Articulata, pl. II, fig. 4, "1855."
Megalobrachium granuliferum Stimpson, Proc. Acad. Nat. Sci. Phila., X, p. 228, 1858; also Annals Lyc. Nat. Hist. New York, VII, p. 76 (March, 1859).

The three lobes of the front extend but little beyond the eyes; the middle lobe is rounded, not noticeably larger and but a trifle in advance of the lateral lobes, which are more angular. The eyes are small. The carapace is rounded; there is a paired depression behind the eye on the gastric region. The areolations are distinct; the surface is pubescent, often covered with sordes; along the front, between and a little behind the eyes, and along the antero-lateral region the surface is sharply granular; a part of the border is marked by a row of granules. The chelipeds are characterized by depressions—two on the carpus and three on the palm. The entire surface is more or less hairy and is coarsely granulated. The hair on the lower portion of the palm and on the fingers is long and coarse and is often covered with dark slime.

Taken among the Bahama Islands at St. Thomas, the Barbados, and at Savanilla.

Genus PORCELLANA.

Porcellana sayana Leach. Plate 3, fig. 10.

Pisidia sayana Leach, Dict. Sci. Nat., XVIII, p. 54, 1820.
Porcellana ocellata Gibbes, Proc. Amer. Assoc. Adv. Sci., III, p. 190, 1850.
Porcellana sagrai Guérin, in La Sagra's Hist. of Cuba, VIII, pl. II, f. 5.
Porcellana sayana Kingsley, Proc. Acad. Nat. Sci. Phila., p. 407, 1879.

The front is triangular and emarginate on the sides; it is well separated from the lateral teeth at the angles of the orbits by wide and moderately deep incisions. The carapace is longer than wide. There is a shoulder where the cervical groove meets the side. The surface is minutely rugose. The chelipeds are short curved, and bent; inner distal angle of merus and proximal inner angle of carpus produced, forming lobes. There is a fringe of long hair on the outer margin of the hands.

This species can readily be distinguished from any other porcellanid of the region by the numerous white spots on a red ground, both on the carapace and feet. A favorite place for this crab is in the spire of a large univalve containing a hermit crab.

Boqueron Bay, Arroyo, station 6086, 14¾ fathoms.

Porcellana stimpsoni A. Milne-Edwards.

Porcellana stimpsoni A. Milne-Edwards, Bull. Mus. Comp. Zool., VIII, p. 35, 1880–81.

Not examined "by the side of *P. sayana*. The carapace is wider. Its front is less advanced; the median point is rounded, lobiform, and it does not pass the inner angles of the eye. The anterior feet are smooth and are not fringed with hair as on *P. sayana*."

Dredged by the *Blake*.

Porcellana sigsbeiana A. Milne-Edwards.

Porcellana sigsbeiana A. Milne-Edwards, Bull. Mus. Comp. Zool., VIII, p. 53, 1880–81.

This species is much the largest of the porcellanids of the region and comes from deeper water, ranging from 25 to 175 fathoms. The front is deeply tridentate; the rostral projection extends beyond and is much larger than the lateral teeth. The lateral margin of the carapace is thin, produced, and is slightly turned upward. The chelipeds are long; to the eye they are smooth and glabrous; under a lens the surface is broken by minute rugæ composed of small granules. The color markings on the carapace, in the alcoholic specimens, consist of lines running longitudinally.

Dredged by the *Blake*.

Porcellana soriata Say.

Porcellana soriata Say, Jour. Acad. Nat. Sci. Phila., I, p. 456, 1818.
Pisidia socia Leach, Dic. Sci. Nat., XVIII, p. 54, 1820.
Porcellana sociata Gibbes, Proc. Am. Assoc. Adv. Sci., III, p. 190, 1850. Kingsley, Proc. Ac. Nat. Sci. Phila., XXXI, p. 407, 1879.

The front appears rounded when seen from above, tridentate from before; the rostral tooth is but little larger than the lateral teeth. The areolations of the carapace are well marked, some are inclined to be tubercular. The ambulatory legs are hairy; the chelipeds are very tuberculose; the tubercles are large and granulated; on the carpus they are placed without regularity, while on the hands they are in more or less well-defined rows; the lower margin of the hands are fringed with hair.

It seems necessary to restore Say's name *soriata*, which was dropped, perhaps, on account of its form or with the belief that the letter *c* was intended where *r* was used. Dr. Gill thinks that the name was suggested to Say by the fact that the aggregations of granules into tubercles on the chelipeds resemble the "sori" of ferns. The word *sorus* itself, he adds, is derived from the Greek σωρός, meaning, primitively, a "heap of corn." With this derivation the name will apply to the species much better than *sociata*, as the tubercles look like heaps of granules.

Southern coast of the United States.

Porcellana pilosa H. M. Edwards. Plate 3, fig. 11.

Porcellana pilosa H. M. Edwards, Hist. Nat. des Crust., II, p. 253; Kingsley, Proc. Acad. Nat. Sci. Phila., p. 406, 1879.

Readily distinguished from all other porcellanids of the West Indian region by the short, stout bristles on all of the feet in connection with the group of white tubercles on proximal portion of carpus. The median projection of the front is rounded and but little in advance of those at angles of the eyes.

Charleston, S. C., to the West Indian region in shallow water; Porto Rico, several localities.

Genus POLYONYX.

Polyonyx macrocheles Stimpson.

Porcellana macrocheles Gibbes, Proc. Amer. Assoc. Adv. of Sci., III, p. 191, 1850.
Polyonyx macrocheles Stimpson, Proc. Ac. Nat. Sci. Phila., x, p. 229, 1858. Kingsley, Proc. Ac. Nat. Sci. Phila., XXXI, p. 408, 1879.

The carapace is ovate and is much wider than long. The orbits are very shallow; the eyes are small; the front is so little produced that it does not interfere with the ovoid outline. The chelipeds are long and slender. The inner margin of the carpus is produced and entire. The hand has a fringe of long hair on its lower border. "The dactyls of the ambulatory feet are short, wide, and bi- or multi-ungulate."

This crab is found in the tubes of *Chætopterus*, on the southeastern coast of the United States and in the Gulf of Mexico, and may yet be taken in the West Indies.

Genus EUCERAMUS.

Euceramus prælongus Stimpson. Plate 3, fig. 12.

Euceramus prælongus Stimpson, American Jour. Sci. and Arts, II, XXIX, p. 445. Kingsley, Proc. Acad. Nat. Sci. Phila., p. 408, pl. XIV, fig. 4, 1879.

This is a small, elongated porcellanid, with a semicylindrical carapace. The front is tridentate; the teeth are sharp, the middle one twice as long as the lateral. The carapace is crossed by minute rugæ; its length is twice the width. The chelipeds are elongated; the palms of the hands are covered with bristles; the ambulatory feet are stout, the fourth pair is the longest.

The figure is from a Union College specimen identified by Mr. Kingsley.

Genus HIPPA.

Hippa cubensis (Saussure).

Hippa scutellata Fabr., Ent. Syst., II, p. 474, 1793.
Remipes cubensis Saussure, Rev. et Mag. Zool. (2), IX, 1857.
Remipes barbadensis Stimpson, Ann. Lyc. Nat. Hist. of N. Y., x, p. 120, 1871.
Remipes scutellatus of authors.
Hippa cubensis, M. J. Rathbun, Proc. U. S. Nat. Mus., XXII, p. 300.

Front trilobate. Antennulæ naked with the exception of a fringe of short cilia on the lower margin of the flagella, which is less than half the length of the carapace. The eye-stalks and antennæ are short. The carapace is depressed, broadest in the middle, tapering much more toward the head than posteriorly. It is bordered on the sides and front with short oblique lines of bristles, which rise from the bottom of grooves such as would be formed by overlapping scales. The bristles are directed forward. The border formed by these lines is broadest at about the posterior third carapace.

Length of specimen, 15 to 25 mm.

Porto Rico; at Ponce, Hucares, Mayaguez, Boqueron Bay. West India regions generally, and the west coast of Africa.

Genus EMERITA.

Emerita talpoida (Say).

Hippa talpoida Say, Journ. Acad. Nat. Sci. Phila., I, p. 160, 1817.
Hippa talpoida of American authors, *H. emerita* in part of others. For synonymy see Miers's Revision of the Hippidea, in the Journ. Linn. Soc. Lond., XIV, p. 323, 1879.

Miss Rathbun[1] has shown that *Remipes* is a synonym of *Hippa*, and that the type of *Hippa* is the *Hippa adactyla* Fabr.=*Remipes testudinarius* Latreille. This makes it necessary to survey other boundaries and to search for another name for the bereft little decapod so common in the shifting sands of our more southern shores, Gronovius in 1763 figured and described both the *Hippa emerita* and the *Remipes scutellatus* of authors under the generic name *Emerita*. After this Scopoli gave the same name to a chelate decapod and referred to figures of Swammerdamm which are intended to represent *Pagurus bernhardus*. If we ignore *Emerita* Gron.[2] for the "sand bugs," it would seem that we must recognize *Emerita* Scopoli for the "hermits" now in the genus *Pagurus*, and so add to the confusion. Although the names of Gronovius have not been universally used, I see no good reason why *Emerita* should not stand.

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[1] Proc. U. S. Nat. Mus., XXII, p. 301, 1900.

[2] Scopoli, Intro. ad Hist. Nat., p. 405, 1777.

The *Hippidæ* of the West Indian region, represented by the genera *Hippa* and *Emerita*, are easily distinguished by the very long antennæ and the hemispherical cross section of the body of *Emerita* in contrast with the short antennæ and much less convex body of *Hippa*. The *Hippidæ* have nonchelate anterior legs; the outline of the carapace is ovate, fitting them for rapid movements in the loose sand along the surf-beaten shores. The young are often in great numbers in more sheltered places. Old and young are a favorite food for fish.

Mayaguez, San Juan. A specimen from Mayaguez is about 25 mm. long, 12 mm. wide.

Genus ALBUNEA.

Albunea gibbesii Stimpson.

Albunea symnista Gibbes, Proc. Amer. Assoc., III, p. 187, 1850.
Albunea gibbesii Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, p. 78, pl. I, fig. 6, Mar., 1859. Miers, Jour. Linn. Soc. Lond, XIV, p. 329.

The front behind the eyes is deeply sinuate. There is a spine on the median line. The margin between the eyes and antennæ is armed with about nine sharp spines. The eye-stalks are lamellate, elongated, triangular, with very small cornea at the apex of the angle. The flagellæ of the antennulæ are multiarticulate and more than twice as long as the carapace. The carapace is subquadrate, little convex on the median line and very convex from side to side. The sides are nearly straight, tapering a little behind. The first three pairs of ambulatory feet have falcate dactyls. The terminal segment in the male is elongated; in the female rounded.

The Albuneas have long antennules and subchelate anterior feet. The carapace is straight on the median line and convex transversely. The anterior outline is truncate.

The species are found from the shore line to the moderate depths. Specimens were dredged at station 6053, San Juan Harbor, in 4 to 7½ fathoms.

Albunea oxyophthalma Miers.

Albunea oxyophthalma Miers, Jour. Linn. Soc. Lond., XIV, p. 329, pl. V, figs. 14 and 15, 1879.

This species is distinguished from the preceding by the slightly more elongated eye-stalks and by the 11 or 12 spines on each side of the anterior margin. Length about 30 mm.

West Indian region.

Genus CENOBITA.

Cenobita diogenes (Latreille).

Pagurus diogenes Latreille, Ency., pl. 284, figs. 2 and 3. (From Catesby.)
Cenobita diogenes H. M. Edwards, Hist. Nat. des Crust., II, p. 240, pl. II, figs. 11–14, 1837.

This genus, as pointed out by H. M. Edwards, is intermediate between the noted cocoa-nut crab of the Pacific Islands and the *Paguridæ*. The West Indian species of the genus *C. diogenes* lives preferably in the heavy shells of *Livona pica* Gmelin, which it drags even up the hills; for this hermit lives on land much of the year, going back to water, some of the islanders say, to get new shells. In reality they visit the water in the breeding season. While *P. diogenes* climbs the hills, I have more frequently met with it in low marshy but shady places. It can readily be distinguished from any other hermit of the region by its earth-roaming habits, its large left cheliped of bluish purple, by its very stout ambulatory legs, its compressed eye-stalk, and by the propodus of the left third foot, which is very deep or compressed.

Boqueron Bay, Ensenada Honda (Culebra), Caballo Blanco Reef, Ponce.

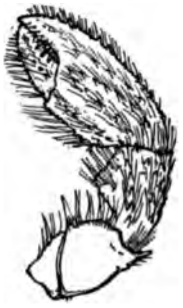
Genus PAGURUS.

Pagurus marshi, new species.

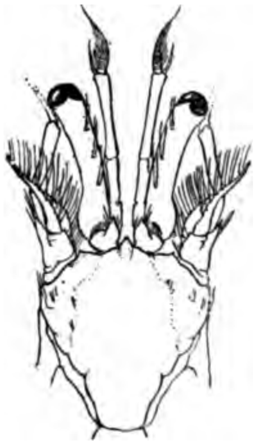
The projections of the front are pointed; the median or rostral point is in advance of the lateral points. Of the four divisions of the frontal line caused by the points, the two middle ones are transverse, forming a shallow sinus behind each eye. The two between the lateral points and the side of the carapace would, if prolonged, meet the median line a little beyond the eye scales. A large space in the middle of the anterior part of the carapace is smooth; near the sides the surface is rough.

The eye-stalks are as long as the entire front and are strongly bent inward from the base to the middle, outward from the middle to the cornea; the scales are broad and rapidly acuminate. The peduncles of the antennulæ are but little longer than the eyes, while the peduncles of the antennæ are about equal in length; the acicles are curved in about the same lines as the eyes.

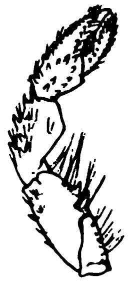
The right cheliped is moderately stout; the merus has a slender spine above on the anterior margin; there are two on each side of the lower margin. There is a row of six spines on the inner margin of the carpus, and seven or eight spines on the upper surface, not arranged in well-defined rows. The hand is oblong-ovate, with six well-defined rows of spines, two of which occupy the margins; a row runs parallel to the inner margin; this and the marginal row are continuous with two rows on the dactyl; the two median rows converge to a common terminal spine near the gape of the fingers; the sixth row runs in a curve to a point near the end of the immovable finger; the lower surface of the palm is smooth. The hand is hairy and in the shell, covered with mud which clings to the hair and the surface between the spines. The left hand is very much smaller than the right; is slender, the hand being but a trifle wider than the carpus. The carpus is compressed and is armed with a few spines on the upper margin. Those on the distal end are the largest. The hand is elliptical in shape with a hiatus between the fingers; a line of spines runs along the outer margin to the end of the immovable finger; another line begins at the inner angle of the articulation with the carpus and runs across the palm to the end of the immovable finger. A short line runs from the opposite angle to the gape of the fingers. This combination of lines incloses an elliptical space, which is smooth or with one or two spines. The ambulatory legs are hairy.



a, Right hand.



Front and anterior appendages of *P. marshi*.



b, Left hand.

Obtained at Ponce, in shells of *Turbo castaneus* Lamarck.

Named for Mr. Millard C. Marsh, of the scientific staff of the *Fish Hawk*, on its expedition to Porto Rico.

Genus PETROCHIRUS.

Petrochirus bahamensis (Herbst)

Cancer bahamensis Catesby, Carolina, p. 34, pl. XXXIV; Herbst, II, p. 30, 1792.
Pagurus granulatus H. Milne Edwards, Hist. Nat. des Crust., II, p. 225, 1837.
Petrochirus granulatus Stimpson, Proc. Acad. Nat. Sci. Phila. 1858, p. 223.

Two small specimens of this species were taken, one at Mayaguez, the other at Boqueron Bay. This is the common hermit inhabitant of the large conch *Strombus gigas*, so frequently met with in the shallow waters of Florida and the West Indies, and is perhaps the largest of the *Paguridæ*.

The front extends forward between the bases of the outer antennæ; the lateral projections are a little in advance of the middle or rostral projection; the outer antennæ are placed in an angle of the front. The anterior portion of the carapace is about as broad as long; is rough and uneven at the sides, with now and then a bunch of stiff bristles. The length of the eyes measured from the front to the extremity of the cornea equals that of the anterior portion of the carapace. A small cuneiform spot of red seems to be uniformly found on the peduncle just below the cornea on the inner side. The eye scales are tapering, with a blunt apex armed with several spinules. The peduncles of the antennæ do not reach the cornea; the flagellum is about three times the length of the anterior carapace; it is strikingly colored with wide annulations of light and dark. The chelipeds are large and very rough; the right hand is the larger. The inner lower edge of the merus and the anterior margins are each armed with a row of spines. The carpus has a row of five spines with horny tips on the inner margin continuous with a similar row on the hand; the surface of the carpus is broken with swellings bearing small conical spines with horny tips; between the swellings are stiff bristles. Similar swellings on the hand are strongly tuberculous; some near the carpus are also spiny. The prehensile edges of the fingers of the right hand are blunt, without teeth or tubercles except near the tips, the fingers of the left hand are well provided with cutting teeth. The ambulatory feet are stout and about as long as the chelipeds; they are rough with spiny margins; the dactyls are stout, with dense rows of bristles above and below.

Small specimens from Mayaguez and Boqueron Bay.

PAGURIAS[1] new name.

Since publishing the statement[2] that "it seemed necessary to change the name of the group of which *bernhardus* is the type to *Pagurus*" I have not seen that the group long known as *Pagurus* has been yet supplied with a name. For this group I propose the name *Pagurias*.

Pagurias insignis (Saussure).

Pagurias insignis H. de Saussure. Mem. sur divers Crustaces nouv. du Mexique et des Antilles; p. 453 (37). Genève, 1858.

The middle front is occupied by a lobe much shorter than the lateral lobes, which are situated between the eyes and the antennæ. The latter project to a point on a line with the bases of the eye scales. The margin beyond the lateral lobes is straight and forms a right angle, with a rounded apex where it meets the side. The eye-stalks are stout, constricted in the middle, and in length, measured from the margin of the front, a little more than equal to three-quarters the width of the carapace. The eye scales are short and broad, with straight inner margins; the blunt tips carry several spines. The antennal peduncle equals the eye in length. The anterior part of the gastric area is inclosed by a rather deep semicircular sulcus and is divided on the median line by a short deep sulcus, which in some specimens is occupied by stiff bristles.

The left cheliped is much larger than the right. Behind the thumb are numerous oblong tubercles surmounted by a comb-like crest of little tubercles; between the large tubercles are fan-shaped fringes of plume-like bristles, which are parallel to the surface; higher up on the hand the form of the tubercles is a little modified. The propodus and dactyl of the second pair of ambulatory feet on the left side are wide; a prominent ridge runs the full length of both articles. Tubercles of the same nature as those on the chelipeds run transversely across the outer surface, interrupted in the middle by a sulcus, at the bottom of which is a row of single tubercles. The fan-like arrangement of bristles is repeated here, but does not occur on the right cheliped or on any other ambulatory leg.

This hermit is a most beautiful object. As preserved in alcohol, the ambulatory feet are banded with red on the merus and carpus; the comb-like tubercles are pink, the bristles of the left second foot and of the left cheliped are yellow, and the white tubercles of the fingers are marked out in the base with scarlet lines.

This is one of the larger hermit crabs of the West Indies. Several fine specimens were taken at Arroyo.

Genus CALCINUS.

Calcinus sulcatus (H. M. Edwards). Plate 5, figs. 3 and 3*a*.

Pagurus sulcatus H. M. Edwards, Hist. Nat. des Crust., II, p. 230.
Calcinus sulcatus Hilgendorf, Monatsber. d. k. Preuss. Akad. d. Wiss. Berlin, p. 823, 1878. Henderson, Challenger Report, XXVII, Anomura, p. 61.

The rostral point is very small and the lateral projections are even less conspicuous. The eyes are longer than the carapace is wide; the scales are slender and terminate in one or two slender spinules.

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[1] The name is composed of the old term *Pagurus* and the suffix *ias*, indicating resemblance of some kind or other; it was in very common use among the ancient Greeks, as exemplified in *Xiphias*, *Anthias*, *Asterias*, and numerous other old names.

[2] Ann. and Mag. of Nat. Hist. (6) XVIII, p. 99, footnote.

The carapace is glabrous and punctate. The left cheliped is much the larger. The propodus of the second ambulatory leg of the left side is wider than those of the other legs and has the sulcus which suggested the name. This pretty little pagurid is the only representative of the genus accredited to the West Indian region. It prefers shells with the more circular apertures, as do many of the pagurids with hands so different in size. The color of the eye-stalks is an orange red, becoming white at the cornea; carapace a rich red, with white punctæ. The chelipeds are red, often tinged with purple.

Ensenada Honda, Culebra; Caballo Blanco Reef, Vieques; Arroyo; Ponce.

Genus CLIBANARIUS.

Clibanarius tricolor (Gibbes). Plate 6, fig. 2.

Pagurus tricolor Gibbes, Proc. American Assoc., 1850, III, p. 189.
Clibanarius tricolor Stimpson, Proc. Acad. Nat. Sci. Phila. 1858, p. 234.

This little *Clibanarius* is unique among the members of the genus inhabiting the region in having the legs conspicuously banded with color rather than longitudinally striped, a character that is so nearly generic. It is found in some localities in great numbers, living in the shells of *Cerithium* of various species and other small gastropods. The orange bands at the proximal ends of the articles of the ambulatory feet remain in the alcoholic specimens, but the "black spots" on the carapace are not present. Gibbes does not mention the single orange stripe on the eye-stalk.

From Ponce and San Juan.

Clibanarius antillensis Stimpson. Plate 6, fig. 1.

Clibanarius antillensis Stimpson. Ann. Lyc. Nat. Hist. of New York, VII, p. 85; part published March, 1859.

The frontal margin is nearly straight, broken only by a very small rostral point; from the angle behind the antenna to the side of the carapace the margin is straight. The length of the eyes is equal to the width of the carapace; the eye scales are short, broad, and truncate, and armed with three or four spinules on the terminal margin. The carapace is elongated, is widest at the anterior third, and is deeply punctate. The chelipeds are armed with numerous sharp conical spines. As occurs in some species of other genera, the propodus and dactyl of the exposed second left ambulatory leg are much wider than the corresponding parts of the right side. On the side of the merus are two white stripes; a single stripe of the same color runs from the merus to the tip of the dactyl; the chelipeds are reddish, with white spines. A small species, averaging but little larger than the preceding.

Mayaguez; Ponce; Boqueron Bay; Ensenada Honda, Culebra; Arroyo.

Clibanarius sclopetarius (Herbst).

Cancer sclopetarius Herbst, Krabben und Krebse, II, p. 23, pl. XXIII, fig. 3.
Pagurus tuberculosus H. M. Edwards, Ann. des Sci. Nat. (2), VI, p. 278, pl. XIII, fig. 1; also Hist. Nat. des Crust., II, p. 229.
Clibanarius sclopetarius Stimpson, Proc. Acad. Nat. Sci. Phila., p. 235, 1858; also in Ann. Nat. Hist. N. Y., VII, p. 85, part published 1859.
Pagurus cubensis Saussure, Crust. Nov. du Mexique et des Antilles, p. 39, 1858.
Clibanarius formosus J. E. Ives, Proc. Acad. Nat. Sci. Phila. 1891, p. 182, pl. V, figs. 1-2.

From Ensenada Honda, Culebra, there is a specimen of this species which comes under Herbst's description. The eye-stalks have faded to an olive green; the stripes on the legs are a brownish purple; the spiny tubercles of the chelipeds are yet greenish; the ground, color is reddish. Three other specimens from Culebra are the same in form, but differ in color—the stripes are a bright crimson; in one specimen the eye-stalks are crimson; in another specimen one eye-stalk is crimson at the base and a very light flesh-color tinged with green near the cornea. From Jamaica a number of specimens come well under H. Milne Edwards's description of *C. tuberculosus*. The color is reddish, with yellow stripes on the legs.

The variation in color is wide; it may be possible, with an abundance of fresh material from many localities, to separate this species into subspecies. The variations in form are slight and do not hold uniformly in specimens from one locality and color. The variation in the length of the eye-stalk is as great as in any part. Among a number of specimens from Jamaica is one with eye-stalks very nearly equal to the length of the anterior portion of the carapace, measuring the eye-stalk from the front to the extremity of the cornea; in other specimens taken at the same time the eye-stalks are much shorter.

Ensenada Honda, Culebra; San Juan.

Genus XYLOPAGURUS.

Xylopagurus rectus A. Milne-Edwards.

Xylopagurus rectus A. Milne-Edwards, Bull. Mus. Comp. Zool., VIII, p. 37. A. Milne-Edwards & Bouvier, Mem. Mus. Comp. Zool., XIV, p. 108, pl. VIII, figs. 1-13. A. Agassiz, Bull. Mus. Comp. Zool., XV, p. 40, 1888.

The front advances gradually from the angle behind the eyes, forming a short rostral point; the eye-stalks are stout and a little elongated; clavate; the cornea is large and swollen. The antennæ are small, the antennulæ large; the eye scales are comb-like; the carapace is elongated, smooth, and semi-cylindrical. The abdomen is obliquely cut, subquadrate, and divided into four or five plates. Two specimens were taken at station 6063 in vegetable tubes. The carapace and feet are red, of several shades; the ambulatory feet are lighter at the joints; the right hand is light beneath. The chelipeds and ambulatory feet are elongated; the right cheliped is very much larger than the left; the upper margin of the palm extends over the movable finger in the form of a large tubercle. All of the legs are free from spines.

Obtained at station 6063.

Genus PAGURISTES.

The Paguristes of the West India region, of which *Paguristes depressus* Stimpson is the type, are numerous and difficult to determine without figures; consequently the 10 species in the U. S. Fish Commission collection and the National Museum collections have been figured for this report.

Key to the group of the genus Paguristes of the West Indian region.

a. Peduncle of the antennules much longer than the eye-stalks.
  b. Rostral projection short and blunt.
    c. Peduncles of antenna longer than eye-stalks .... *sayi*
    cc. Peduncles of antenna shorter than eye-stalks .... *lymani*
  bb. Rostral projection long and slender .... *triangulatus*
aa. Peduncles of antennules not longer than eye-stalks.
  d. Eye-stalks measured from extremity of rostral point to end of cornea longer than distance between antero-lateral angles.
    e. Rostral point acute.
      f. Carapace very convex .... *spinipes*
      ff. Carapace very much flattened.
        g. Rostrum broad at base, triangular .... *sericeus*
        gg. Rostrum long and slender .... *depressus*
    ee. Rostral point obtuse .... *tæniatus*
  dd. Eye-stalks shorter than the front.
    h. Base of the rostrum anterior to the line of the antero-lateral angles.
      i. Outline of the front almost straight.
        k. Rostrum slender from base to tip .... *tenuirostris*
        kk. Rostral projection short, rounded .... *planatus*
      ii. Outline of the front much curved at the sides.
        l. Rostrum not spiny .... *puncticeps*
        ll. Rostrum usually with one or more spines on each side .... *grayi*
    hh. Base of the rostrum posterior to line of antero-lateral angles .... *rectifrons*

Paguristes tenuirostris, new species. Plate 4, fig. 1.

The rostrum in this species is more slender than in any species yet examined by me; its sides are parallel from the base to near the acute tip. The general outline of the front is much like that of *P. rectifrons*, but the sinus behind the eyes is in advance of the line of the antero-lateral angles. The straight appearance of the front is heightened by the fact that the rostrum and the tips of the projections between the eyes and antenna are colored to correspond with the peduncles of the eyes and antenna, which are red, spotted with white, as in *P. puncticeps*, except that the color fades out rapidly from the middle of the eyes. The terminal segment of the antennal peduncle is armed with two spines. The carapace is white and very flat, and even in strong contrast with that of *rectifrons*.

One male, from *Grampus* station 5077, in 68.5 fathoms, Gulf of Mexico, off west coast of Florida.

Paguristes sayi A. Milne-Edwards & Bouvier. Plate 4, fig. 2.

Paguristes sayi A. Milne-Edwards & Bouvier, Mem. Mus. Comp. Zool., XIV, No. 3, p. 55, pl. V, figs. 1-7, 1893.

The rostral and lateral projections of the front in this species are about equally advanced; the rostrum is a rounded lobe. The eye-stalks are short, equaling in length about five-eighths of the width of the carapace. The terminal segment of the peduncle of the antennula extends beyond the cornea nearly the entire length, that of the antenna one-third of its length. The carpus, propodus, and dactyl of the first pair of ambulatory legs are spiny along the upper margin; the carpus has four large spines on its inner border, also four on the crest of the palm; in addition to more or less scattering large, spiny granules, there is a prominent row extending from the wrist to the gape of the fingers.

In general this specimen agrees with that figured by Milne-Edwards & Bouvier, but the rostrum of their specimen is pointed and the eyes are figured as more slender. This is so close to *sayi* that I am unwilling to call it new. One male was dredged by the *Albatross* at station 2655, in 338 fathoms.

Paguristes moorei, new species. Plate 4, fig. 3.

The rostrum is short, rounded, not quite reaching the line of the tips of the projections of the front between the eye-stalks and the insertions of the antenna. From these points the front retreats rapidly to the well-rounded antero-lateral angles. The eye-stalks are about one-fifth longer than the entire front. The peduncles of the antenna extend a little beyond the middle of the eye-stalk; the terminal segment is unarmed. The peduncles of the antennula do not extend quite to the extremity of the cornea. The chelipeds are rather narrow, the outline of the hand is slightly elongated, with a straight margin where the two hands come together in close contact; the lower or outer margins are concave. The outer surface is well covered with small tubercles surmounted by spinules with small horny tips; the crest of each hand is armed with five small, stout spines; the hands are hairy. The first pair of ambulatory feet are spiny along the outer margin of the carpus and propodus. The color of the eye-stalks in the single specimen from Porto Rico is a deep crimson, with a single stripe of white along the upper surface.

Named for Dr. H. F. Moore, the naturalist of the *Albatross* and a member of the scientific staff of the *Fish Hawk* on its expedition to Porto Rico.

Paguristes puncticeps, new species. Plate 4, fig. 4.

The rostrum in this species is elongated, broad at the base and acuminate. The margin of the carapace behind the antenna falls away to the rounded antero-lateral angles. The eye-stalks are about one-sixth shorter than the front, measured between the angles. The peduncles of the antenna extend a little beyond the middle of eye-stalks; the terminal segment is normally armed with three spines, though many individuals have but two. The peduncles of the antennules do not reach the cornea. The chelipeds differ from those of *P. sericeus* in having a straighter outline of the movable finger and crest of the palm, which brings the margins of the hands in contact as they withdraw into the shell. The outer surface is paved with small tubercles which are surmounted with small horn-tipped spines. The surface is obscured with long hair. The carpus and propodus of the first pair of ambulatory legs are spiny, in the second pair the segments are almost smooth. In alcoholic specimens the color of the eye-stalks and peduncles of the first and second antennæ is pink spotted with white.

Several specimens of this species were collected at Kingston, Jamaica, in shallow water, March 1884, by the U. S. Fish Commission.

Paguristes depressus Stimpson. Plate 4, fig. 5.

Paguristes depressus Stimpson, Annals Lyc. Nat. Hist. New York, VII, p. 87, March, 1859.

"Carapax flattened, naked; posterior portion much expanded; sides of the anterior portion short, the transverse suture reaching far forward laterally; surface rugulose; lateral sinuses spinulose. Anterior cardiac lobe narrow halberd-shaped, somewhat widening toward its blunt posterior extremity. Rostrum elongated, reaching nearly to the middle of the opthalmic scales, with its lip embedded in the rounded tubercle of the opthalmic ring, which is exposed in this species. Eyes very large, much overreaching the tip of the peduncle of the very slender antennulæ. Opthalmic scales with bidentate tip—margins of apex entire. Antennæ short; terminal joint of peduncle and flagellum very slender, almost naked; acicle slender, spinous, and hairy. Chelipeds equal, broad and depressed, almost naked; merus scabrous above; carpus minutely spinulose and armed with four spines on the inner edge; hand uniformly minutely granulated with five tubercles on the inner edge of the palm; fingers with sharp cutting inner edges; tips not spiniform; immovable finger concave below; dactyls nearly three times as long as the inner edge of the palm. Ambulatory feet above scabrous, spinulose, and setose; dactyli, with a dense series of longer setæ along the superior and inferior edges. The inner side of the penult and terminal joints in the left second foot is concave.

The following are the measurements of a female specimen: total length, 3 inches; length of carapace, 0.77; breadth of front, 0.40; length of eye, 0.41; length of chelipeds, 1.05 inches."

A male and a female of this species were taken by the *Fish Hawk* at Mayaguez, Porto Rico. The eye-stalks and chelipeds are a rich orange red. The species is readily distinguished from all others of the genus yet found in the West Indian region by the broad, spineless, evenly granulated hands; its nearest relative is the *Paguristes digueti*, of Bouvier, found on the west coast of Mexico.

Paguristes spinipes A. Milne-Edwards. Plate 4, fig. 6.

Paguristes spinipes A. Milne-Edwards, Bull. Mus. Comp. Zool., VIII, p. 44, 1880.
Paguristes risor J. R. Henderson, Challenger Report, XXVII, Anomura, p. 78, pl. VIII, fig. 3, 1888.
Paguristes spinipes A. Milne-Edwards & Bouvier, Mem. Mus. Comp. Zool., XIV. No. 3, p. 33, pl. III, figs. 1-13, 1893.

The rostrum is broad at the base, the sides are straight, meeting at the sharp apex; from the lateral projections the front retreats rapidly and rounds into the sides without forming an appreciable angle, as in *P. lymani* and *P. sayi*. The eye-stalks are very much longer than the greatest width of carapace. The carapace is more convex than in any other species of the *depressus* section of the genus. The peduncles of the antennula reach the cornea; those of the antenna are about half the length of the eyes, the terminal segments are unarmed, acicles elongated, slender, with tips 2 or 3 spined.

Taken by the *Albatross*, at station 2354, in 130 fathoms, one female.

Paguristes rectifrons, new species. Plate 4, fig. 7.

The rostrum is triangular and is inserted posterior to the general line of the front. The front is remarkable for its linear appearance from angle to angle; the projections between the eyes and antenna are low; between the bases of these projections and the antero-lateral angles the margin is straight. The eye-stalks are but little shorter than the width of the front. The peduncles of the antennula reach the cornea, those of the antenna but little more than one-half of the eye-stalk; the terminal segments of the antenna are armed with two spines; the acicle is forked and has a prominent spine on the side. The carapace is flattened and has several spines on the side. The chelipeds are short and rather stout, the carpus is broad, with two large spines on the inner margin and several smaller ones on the surface near by; the hand is broad and is shaped very much as the hand of *P. sericeus*, as shown in fig. 17, pl. III, Blake Paguridæ, Edwards & Bouvier. The crest is armed with five spines; spines of smaller size fringe the lower margin and the margin of the dactyl.

Paguristes rectifrons is separated from *P. sericeus* by the much shorter eye-stalks, by the front, which in *sericeus* is not so straight, and by the different armature of the hand and carpus.

Dredged by the *Fish Hawk*, at station 6085, in 14 fathoms, one male in the shell of *Strombus pugilis*.

Paguristes lymani A. Milne-Edwards & Bouvier. Plate 4, fig. 8.

Paguristes lymani A. Milne-Edwards & Bouvier, Mem. Mus. Comp. Zool., XIV. No. 3, p. 49, pl. IV, figs. 13-22, 1893.

The rostrum is a rounded lobe in the sinus behind the eyes; from the projections which limit this sinus the front rounds gradually into the lateral margin. The eye-stalks are short; when laid off on the front they reach from the middle of the insertion of one antenna to the middle of the other. The peduncles of the antenna reach the base of the cornea and those of the antennula extend beyond for three-fourths of the length of the last segment. The terminal segment of the peduncle of the antenna is unarmed. The sides of the carapace are roughened by spiny granules. The chelipeds are small, the hand is narrow with a few rather large tubercular granules on the surface and four spines on the crest of the palm; the lower margin of the palm is concave at the base of the immovable finger; the closed fingers show a small hiatus. The upper surface of the carpus has three rows of spines.

four large ones on the high inner margin and six on the surface a little nearer the inner margin than the outer, which is armed with six spines graded in size, the distal one being the largest.

One specimen of this species was dredged by the *Albatross* at station 2659, in 509 fathoms.

Paguristes triangulatus A. Milne-Edwards & Bouvier. Plate 4, fig. 9.

Paguristes triangulatus A. Milne-Edwards & Bouvier. Mem. Mus. Comp. Zool., XIV, No. 3, p. 40, pl. IV, figs. 6–12, 1893.

The rostrum is slightly elongated, acuminate, the lateral projections are rendered prominent by the margin behind the antenna, which retreats in a straight line to the antero-lateral angle. The peduncle of the antenna is four-fifths as long as the eye; the peduncles of the antennula are much longer. This species can be distingüished from all of the others by the triangular cross section of the dactyls of the second pair of ambulatory feet. Color of eye-stalks light rose pink.

A number of specimens were taken by the *Albatross* at station 2121, in 31 fathoms, off Trinidad.

Paguristes grayi, new species. Plate 5, figs. 1 and 1*a*.

The outline of the front is closely like that of *P. puncticeps;* it is, however, well separated from that species by the character of the rostrum and also of the eye scales. A comparison of all parts, while showing the close relationship, shows a marked difference in detail. The rostrum in two of the three specimens is armed with lateral spines and a spine at the tip; this latter armature is also found on the rostrum of *puncticeps*. The largest specimen is a female; in this case the rostrum has two spines on each side; in a smaller specimen, a male, there is but a single spine on each side; the other small specimen has a spine at the apex, but none on the side.

The peduncles of the eyes are elongate but shorter than the front, the scales are rather broad at the end, armed with a spine at the outer angle; the inner angle is produced slightly, making a notch between it and the spine. The peduncles of the antennæ are but little more than one-half the length of the eye-stalk; there are three spines on the terminal segment; the spines of the acicle are large.

The chelipeds are stout with a broad hand, as in *puncticeps;* the spines are larger and more numerous; the horny tips of the spines are much more prominent. The inner surface of the palm is much more spiny than in *puncticeps*; the spines, as in other places, are large and black-pointed.

The first pair of ambulatory feet are spinose; the spines have the same characters as those of the chelipeds; the crests of the propodus and dactyl are thin and overhanging, forming a deep sulcus on the anterior surface; the spines of the posterior pair of legs are very much less in numbers and size.

San Antonio Bridge, San Juan, Porto Rico.

This species is named for the collector, Mr. G. M. Gray, of the Marine Biological Laboratory at Woods Hole, Mass.

Genus MUNIDA.

The following is the key to the section of the genus *Munida*, of which *M. stimpsoni* is the type:

a. Without middle gastric spines.. *stimpsoni*
aa. With middle gastric spines.
  b. Supraocular spines shorter than the eyes; not divergent .... *flinti*
  bb. Supraocular spines longer than the eyes; divergent.
    c. Posterior margin of the carapace with more than one pair of spines .... *evermanni*
    cc. Posterior margin of the carapace with one pair of spines .... *affinis*

Munida evermanni, new species. Plate 5, fig. 4.

The rostrum and supraocular spines, as seen from above, are about as long as in *affinis*, but differ in being a little more divergent, not so rough, and the supraoculars are broader. The spines of the gastric region are as in *affinis*, as are also the other spines of the carapace, with the exception of those of the posterior border, which is armed with six or eight spines in place of the two common to the other three species of the group. The lines of the carapace differ very much from those of the other species. They are well separated and ciliated, but the cilia are not numerous enough to obscure the carapace; the lines are made prominent by the very large and separated granules. In comparison with those of the other species perhaps tubercles would be a more suitable name. The armature of the abdomen is about like that of *affinis*, except that the spines are proportionately larger. The chelipeds are elongated, slender, and have more spines than the other species of the group. The spines are themselves characteristic, being thin and broad. The crest of the palm bears about ten of these spines.

Station 6070, in 220 fathoms.

This species is named for Dr. Barton Warren Evermann, the chief naturalist of the *Fish Hawk* expedition to Porto Rico.

Munida affinis A. Milne-Edwards.

Munida affinis A. Milne-Edwards, Bull. Mus. Comp. Zool., VIII, p. 48, 1880.
Munida affinis A. Milne-Edwards & E. L. Bouvier, Ann. Sci. Nat. Zool. (7) XV, XVI, p. 2573, 1894.

The rostrum extends beyond the eyes about one-half of its length. The supraocular spines are a little divergent and extend beyond the eyes but little. Both the rostrum and these spines are roughened by sharp granules. The gastric region has normally seven spines, the large gastric pair, and a secondary pair of much smaller ones directly behind the first pair and the spine on the median line, and a paired spine near the hepatic region; sometimes the middle spine has one or more spines in line with and close to it. There is a paired spine on the branchial region behind the fork of the cervical suture, and a spine on the median line on the anterior margin of the cardiac region. The posterior margin of the carapace is armed with one pair of spines.

The transverse lines of the carapace are crowded and broken; the granules with which these lines are set are very small and sharp; the cilia of the lines reach from line to line.

All specimens examined (about twenty) have a patch of long, silky, iridescent hair on the side of the branchial region, where it is covered by the knee of the fifth pair of legs. This hair is, as far as I have been able to observe, altogether lacking in the related species. The prominent armature of the abdomen is the middle pair of spines on the second, third, and fourth segments, in connection with the spine on the median line near the posterior border of the fourth segment. Smaller spines occur on the sides of the armed segments.

Munida stimpsoni A. Milne-Edwards.

Munida stimpsoni A. Milne-Edwards, Bull. Mus. Comp. Zool., VIII, p. 47, 1880. Henderson, Anomura of the Challenger, Zool., XXVII, p. 126, pl. XIV, fig. 1, 1888. A. Milne-Edwards and E. L. Bouvier, Mem. Mus. Comp. Zool., XIX, No. 2, p. 48, pl. IV, figs. 1–13, 1897.

The rostrum is longer and much more slender than that of *M. affinis*. The supraocular spines are a little divergent, without granulations, and extend a little beyond the cornea. The gastric region has six spines placed as in *flinti*—two pairs in line directly behind the supraoculars and a paired spine near the hepatic area. The transverse lines of the carapace are well separated and bear rows of cilia, which occupy about one-half of the space between the ridges. The posterior margin of the carapace has two spines. Three segments of the abdomen are armed; the fourth segment, in all specimens from off Habana, lacks the median spine. A specimen from the west end of Cuba, which I can not separate from *S. stimpsoni* by the lines of the carapace, has both a spine on the middle gastric region and a median spine on the fourth abdominal segment; the rostrum is not as long as in the more typical specimens and is rougher. A number of specimens from that locality may show the specimen to belong to a distinct species. The chelipeds of the typical specimens are long; the hands broaden slightly from the wrist to the base of the fingers; under a lens twelve or more spines can be made out on crest of palm. The outer surface of the palm is set with sharp granules and is hairy.

Albatross stations 2166 in 196 fathoms, 2321 in 230 fathoms, and 2341 in 143 fathoms.

Munida longipes A. Milne-Edwards.

Munida longipes A. Milne-Edwards, Bull. Mus. Comp. Zool., VIII, p. 50, 1880–81. A. Milne-Edwards & Bouvier, Mem. Mus. Comp. Zool., XIX, No. 2, p. 44, pl. III, figs. 9–13, 1897.

The rostral spine is a little shorter than the lateral spines of the front; the eye-stalk is short and very much constricted, while the cornea is spreading. The gastric region has a pair of slender spines, as is usual in the genus. There are three spines just behind the cervical suture—one on the median line and one, a paired spine, near the middle of the side. There are three or four spines on the margin behind the suture and two on the posterior border. The second and third abdominal segments have each seven spines, and the fourth has two. The chelipeds and ambulatory legs are more than three times as long as the carapace from the posterior margin to the tip of the rostral spine. Legs spiny.

From station 6070, in 220 fathoms.

Genus UROPTYCHUS.

Uroptychus uncifer (A. Milne-Edwards).

Diptychus uncifer A. Milne-Edwards, Bull. Mus. Comp. Zool., VIII, p. 63, 1880. A. Milne-Edwards & E. L. Bouvier, Ann. Sci. Nat. Zool. (7) XVI, p. 306, 1894; also Mem. Mus. Comp. Zool., XIX, p. 140, part 2, pl. XI, figs. 1 and 2, pl. XII, figs. 17–29, 1897.

The rostrum extends but a trifle beyond the eyes. Two spines on the antero-lateral angles are all that arise from the carapace, which is markedly smooth. The carapace is broadest about one-fourth of its length from the posterior margin; the sides are but little arcuate. The chelipeds are elongated; the margins of both the carpus and palm are parallel except near the articulations; fingers of band hairy, as are also the dactyls of ambulatory legs; hairs on other parts few and inconspicuous.

Station 6065, in Mayaguez Harbor, 4 to 6 fathoms, and station 6070, in 220 fathoms.

Genus MUNIDOPSIS.

Subgenus OROPHORHYNCHUS.

Orophorhynchus platirostris A. Milne-Edwards & Bouvier.

Orophorhynchus platirostris A. Milne-Edwards & Bouvier, Ann. Sci. Nat. Zool. (7) XVI, p. 287, 1894; also Mem. Mus. Comp. Zool., XIX, No. 2, p. 114, pl. IX, figs. 12–15; pl. X, fig. 3, 1897.

The rostrum is broad at the base; beyond the eye-stalks it forms a nearly equilateral triangle; its sides posterior to the ends of the eye-stalks are parallel. Behind the rostrum on the gastric region are two tubercles. The sides of the carapace are arcuate and are divided by two small notches into three parts; the posterior part is emarginate and twice as long as the lobe-like second part, which is in turn more than twice as long as the third division, which includes the antero-lateral angle. The carpus and propodus of the ambulatory legs are carinate. The chelipeds are moderately long and stout, the hands are oblong-ovate.

Orophorhynchus is a subgenus of *Munidopsis* far removed from the typical forms of the genus.

Station 6070, in 220 fathoms.

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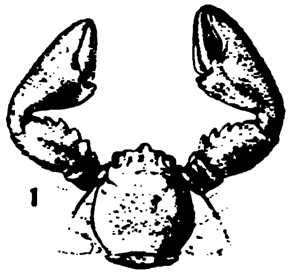

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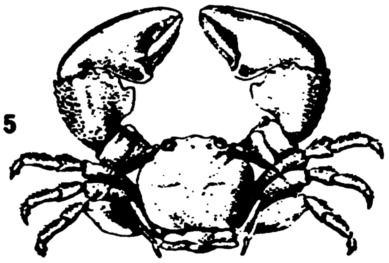

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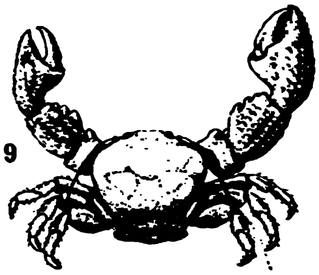

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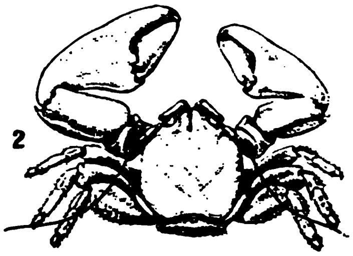

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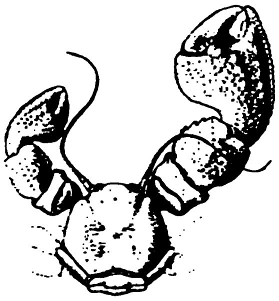

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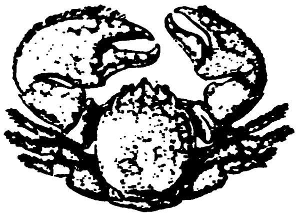

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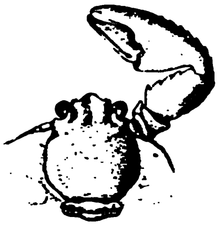

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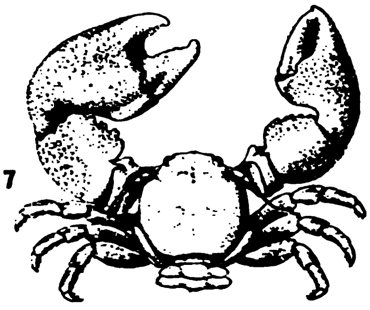

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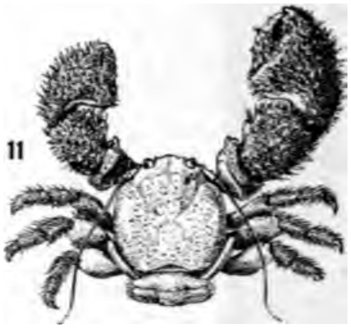

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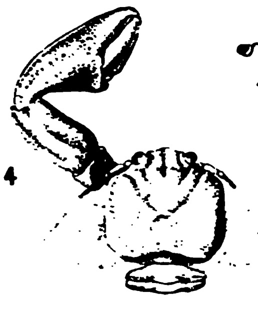

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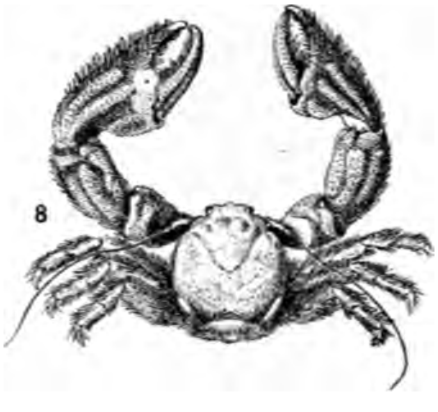

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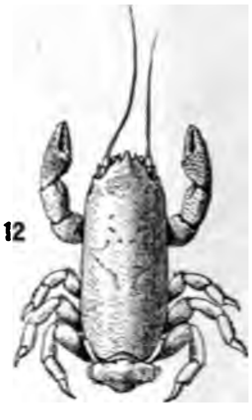
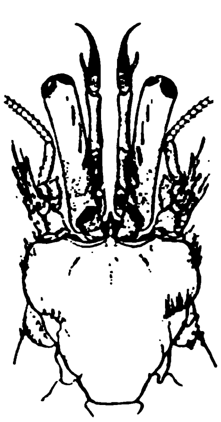


1. *Petrolisthes marginatus* Stimpson, × 3.
2. *Petrolisthes tridentatus* Stimpson, × 1½.
3. *Petrolisthes amœnus* (Guérin), × 3.
4. *Petrolisthes quadratus*, n. sp., × 3.
5. *Pisosoma glabra* Kingsley, × 3.
6. *Pisosoma angustifrons*, n. sp., × 3.
7. *Pisosoma serrata*, n. sp., × 3.
8. *Megalobrachium poeyi* (Guérin), × 1½.
9. *Pachycheles rugimanus* A. Milne-Edwards, × 3.
10. *Porcellana sayana* (Leach), × 1½.
11. *Porcellana pilosa* Edwards, × 1½.
12. *Euceramus prælongus* Stimpson, × 2½.

PLATE 4.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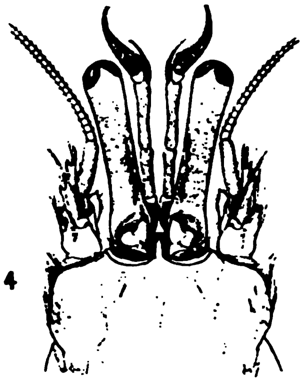
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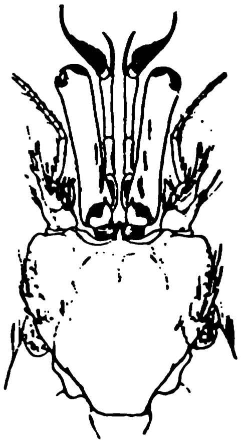
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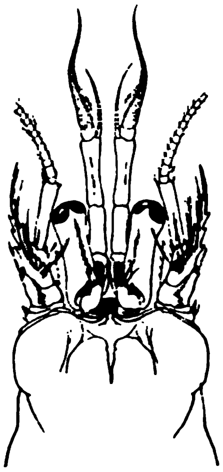
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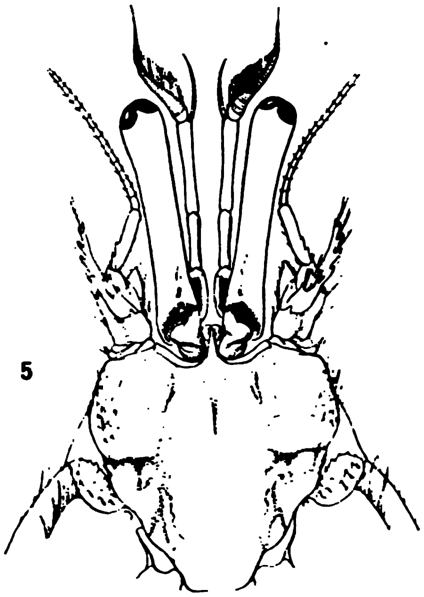
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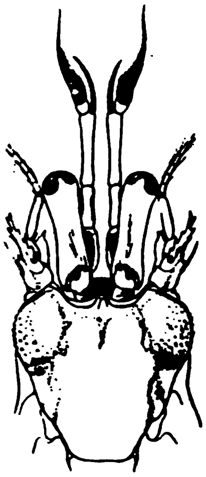
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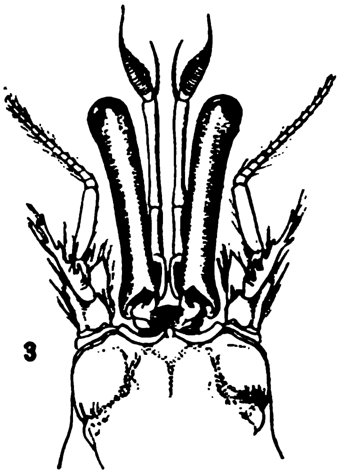
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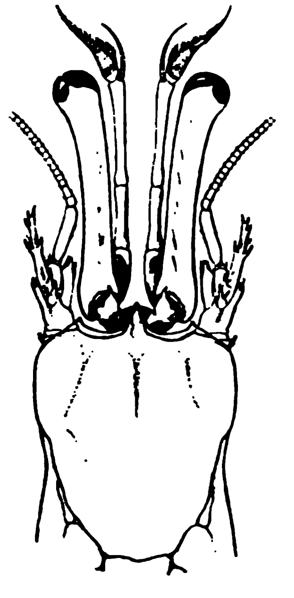
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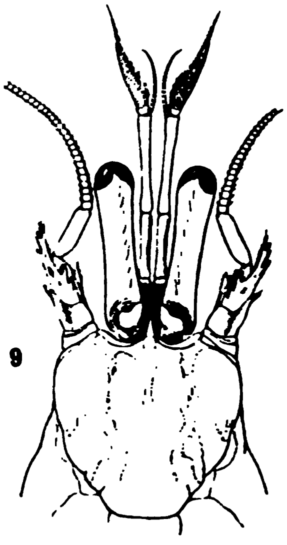
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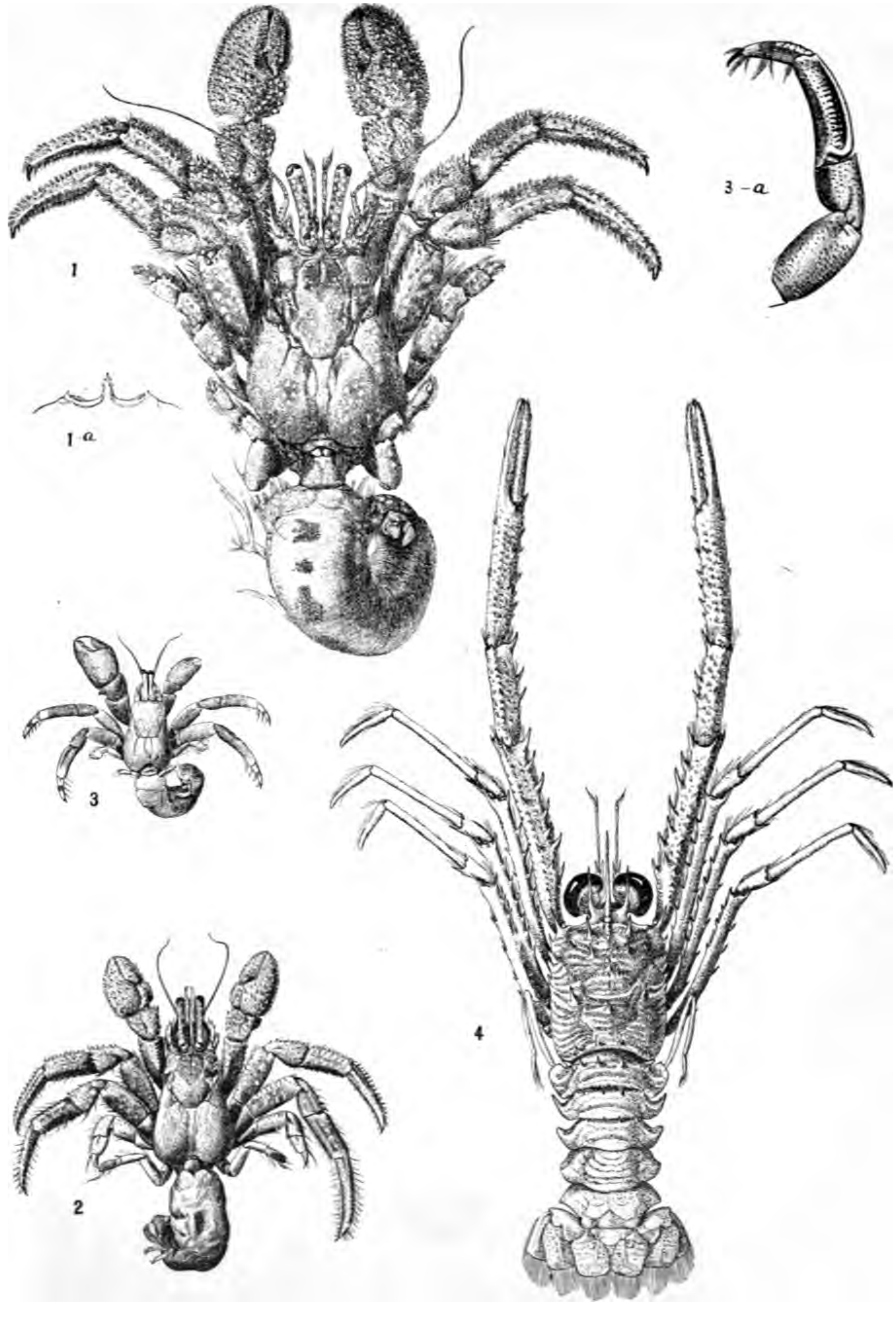
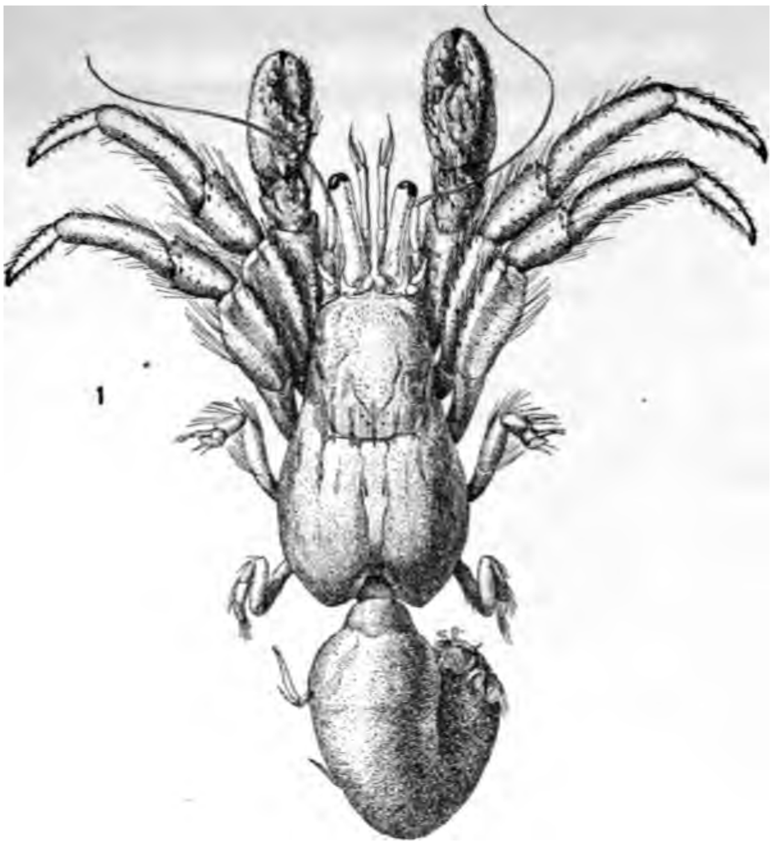
1. ***Paguristes tenuirostris***, n. sp., × 3.
2. ***Paguristes sayi*** E. & B., × 3.
3. ***Paguristes moorei***, n. sp., × 3.
4. ***Paguristes puncticeps***, n. sp., × 3.
5. ***Paguristes depressus*** Stimpson, × 3.
6. ***Paguristes spinipes***, A. Milne-Edwards, × 3.
7. *Paguristes rectifrons*, n. sp., × 3.
8. *Paguristes lymani* E. & B., × 3.
9. *Paguristes triangulatus* E. & B., × 3.



1. *Paguristes grayi*, n. sp., × 1½.
2. *Paguristes puncticeps*, n. sp., natural size.
3. *Calcinus sulcatus* (Milne-Edwards), slightly enlarged.
4. *Munida evermanni*, n. sp., × 2.



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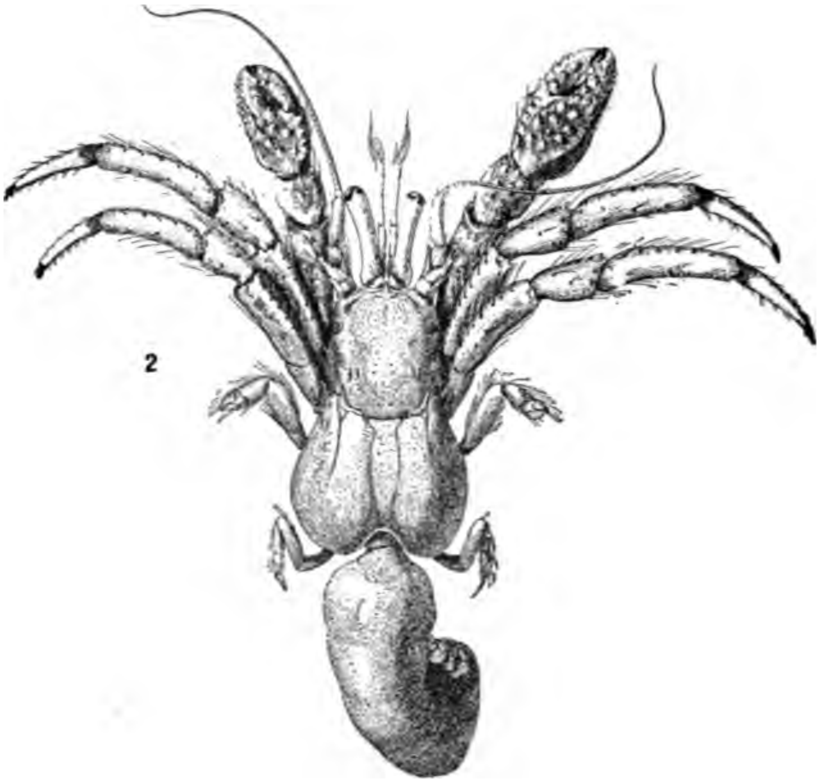

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Fig. 1. *Clibanarius antillensis* Stimpson, × 6. Fig. 2. *Clibanarius tricolor* (Gibbes). × 8.

THE STOMATOPODA OF PORTO RICO.

BY

ROBERT PAYNE BIGELOW, Ph. D.,
Of the Massachusetts Institute of Technology.

THE STOMATOPODA OF PORTO RICO.

By ROBERT PAYNE BIGELOW,
Of the Massachusetts Institute of Technology.

The report herewith presented relates to the Crustacea of the order Stomatopoda collected by the *Fish Hawk* in the waters of Porto Rico during the investigations of the U. S. Fish Commission in the winter of 1898–99. Collections were made at 19 dredging stations in the harbors and off the coast of Porto Rico, and many specimens were picked up by collecting parties in shallow water upon the coral reefs and shoals. The collection consists chiefly of two common species, *Gonodactylus œrstedii* Hansen and *Pseudosquilla ciliata* Miers. The three other species represented are *Squilla intermedia* Bigelow and two new species, *Lysiosquilla plumata* and *L. mayaguesensis*.

The Stomatopoda may be distinguished from the other malacostracous crustacea by the fact that the stalked eyes and first pair of antennæ are borne upon distinct movable segments. The carapace is small, leaving four thoracic segments exposed behind it, and the rostrum is separated from it by a mobile joint. The second pair of thoracic limbs are very characteristic of the group, being developed into the large raptorial claws, in which the terminal segment (dactylus) closes upon the penultimate one (manus) like the blade of a penknife. The next three pairs of limbs, although smaller, are of the same pattern, and it is only the last three pairs of thoracic limbs that are used for walking. The abdominal appendages bear tufted gills, except the last pair (uropods), which are armed with a strong prolongation of the basal segment ending in one or two spines, and act with the telson as a powerful tail fin.

For definitions of the technical terms used and for synopses of genera and species not represented in the present collection the reader is referred to the report on the *Albatross* collections (Bigelow '94) and to the more recent memoirs listed on p. 160.

I wish to take this opportunity to express my obligations to Prof. H. C. Bumpus for his kindness in granting me every facility for the study of this collection at the marine laboratory of the United States Fish Commission at Woods Hole.

Figs. 2, 3, 4 were drawn by Miss McKnew; the other figures by the author.

Genus GONODACTYLUS Latreille.

Diagnosis.—Species of this genus are distinguished by the possession of a flexible joint between the sixth abdominal segment and the telson; a strongly built and highly convex hind-body; the dactylus of the raptorial claw being dilated at the base, without lateral teeth, and with a sharp inner edge that fits into a groove on the manus.

Larval form.—A *Gonerichthus* Brooks, recognizable by the following characters: Eyes stalked; appendages I–VII and XIV–XVII present in the earliest stages; telson usually quadrate or hexagonal in general outline, slightly wider than long, longer than outer spine of uropod and notched on the median line, and with never more than four intermediate denticles; body elongated, carapace narrow, shallow, not infolded, without prominent ventro-lateral angles, posterior lateral spines close to dorsal median line and at least half as long as carapace; never any trace of lateral teeth upon the raptorial dactylus.

Gonodactylus œrstedii Hansen. (Figs. 1 and 2.)

Gonodactylus chiragra, Smith, S. I., Brazilian Crustacea. Trans. Conn. Acad., II, p. 41, 1869. Milne-Edwards, A., Nouv. Arch. Mus. Hist. Nat., vol. IV, p. 65, 1868. Martens, E. v., Cubanische Crust. Arch. f. Naturg. Jahrg. 33, Bd. II, p. 147, 1872. Brooks, Voyage of H. M. S. *Challenger*, XVI, II, p. 56, 1886. Brooks, Mem. Nat. Acad. Sci. V, p. 353, pls. I and III, 1892. Bigelow, Stomatopoda collected by the steamer *Albatross*, Proc. U. S. Nat. Mus., vol. XVII, p. 495, 1894.

Gonodactylus œrstedii, Hansen, H. J., Isopoden, Cumaceen, und Stomatopoden, Ergebnisse der Plankton-Expedition der Humboldt-Stiftung, Bd. II, G. e., footnote p. 65, 1895. Rankin, Crustacea from the Bahamas, Ann. N. Y. Acad. Sci., XI, p. 253, 1898. Borradaile, Crustaceans from the South Pacific, Proc. Zool. Soc. Lond., 1898, p. 35, pl. V, fig. 3.

Diagnosis.—A *Gonodactylus* having cylindrical eyes; the rostrum transverse, with an acute median spine as long as half the width of the rostrum and elevated somewhat above the rounded lateral angles; a smooth carapace, nearly oblong, the posterior margin being very slightly concave and the rounded anterior lateral angles projecting forward; hind-body strongly convex; the lateral margins of the first exposed thoracic segment not produced, the margins of the next three segments rounded; the first five abdominal segments smooth above, with marginal carinæ and rounded posterior lateral angles; sixth abdominal segment with 6 longitudinal dorsal carinæ, the submedian and intermediate pair being well rounded prominences more or less elliptical in outline and often possessing a minute posterior spine, which may, however, be obsolete or absent, the lateral pair narrow, ending in the strong posterior lateral angles, and with a transverse carina extending between the ends of the lateral carinæ and, when the abdomen is fully extended, hidden under the posterior margin of the fifth segment; 3 high rounded longitudinal dorsal prominences on the telson, submedian spines large, with minute mobile tips and finely serrated on the inner edge, intermediate spines prominent, and lateral pair obsolete; 6 marginal carinæ, each intermediate one having on its inner side a shorter *supplementary carina;* the surface of these sculpturings being smooth and polished, except that the supplementary carinæ are sometimes slightly serrated and the intermediate central prominences sometimes show faint indications of a posterior spine; and the basal prolongations of the uropod ending in 2 flattened curved spines, of which the outer one is the longer.

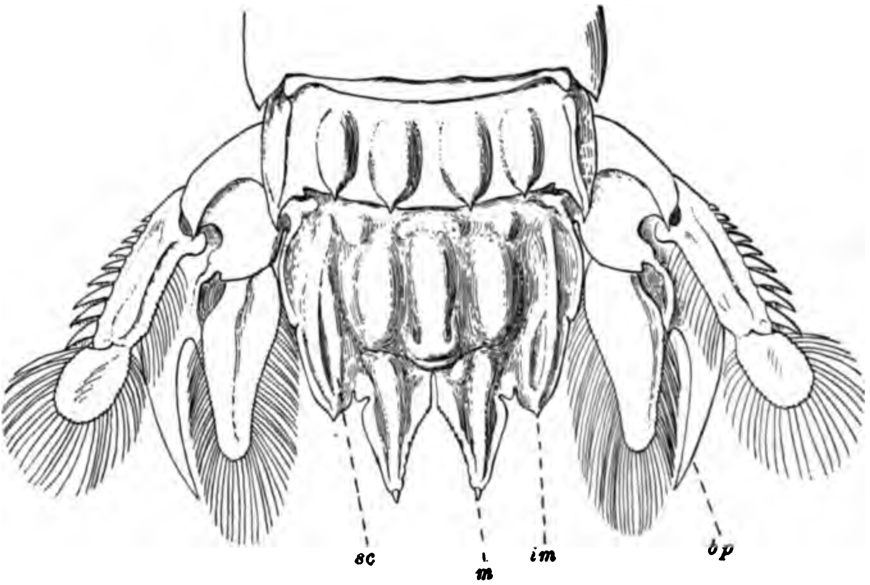


Fig. 1. Telson and adjacent parts of *Gonodactylus œrstedii*. Female, × 5; *sc*, supplementary carina; *im*, intermediate spine; *m*, mobile tip of submedian spine; *bp*, basal prolongation of europod.

General description.—This form is so very similar to *G. chiragra* Fabr. that most authors have identified it with that species. S. I. Smith ('69) stated that he found a slight difference between the American species and the true *G. chiragra*, but Hansen ('95) is the first to describe this as a distinct species and to point out the character by which it can be recognized. This distinguishing characteristic is the small supplementary carina (*sc*, fig. 1) on the inner side of each intermediate marginal carina on the telson. This is so small a character by which to separate two species, otherwise apparently identical, that one would be inclined to suspect that this might be a case of individual variation. But through the courtesy of Dr. Walter Faxon I have been able to examine the material in the Museum of Comparative Zoology at Harvard College and to compare specimens of *G. œrstedii* identified by Dr. Hansen with specimens from 18 localities on the Atlantic, besides those of the present collection, and with specimens of *G. chiragra* from 16 localities in the Pacific and Indian oceans. I found that the difference pointed out by Hansen is perfectly constant. In every specimen of *G. chiragra* from the Indo-Pacific region the valley between the intermediate marginal carina and the central prominences of the telson presented a smooth, even slope, without trace of additional carina. On the other hand, every specimen from the Atlantic region possessed the supplementary carina, somewhat variable in length and elevation, but always distinctly present. It may be well to note here that in order to see this feature, as well as the other sculpturings of the telson, distinctly, the surface must be dry. In a specimen freshly lifted from a bottle of alcohol and covered with the liquid it is not easily visible.

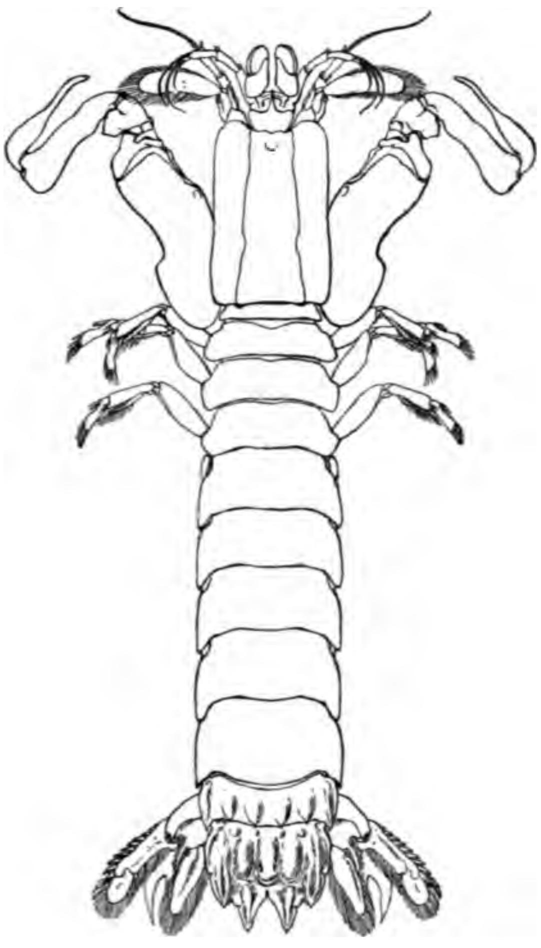


FIG. 2. *Gonodactylus œrstedii*, Hansen, × 2; not accurately to scale.

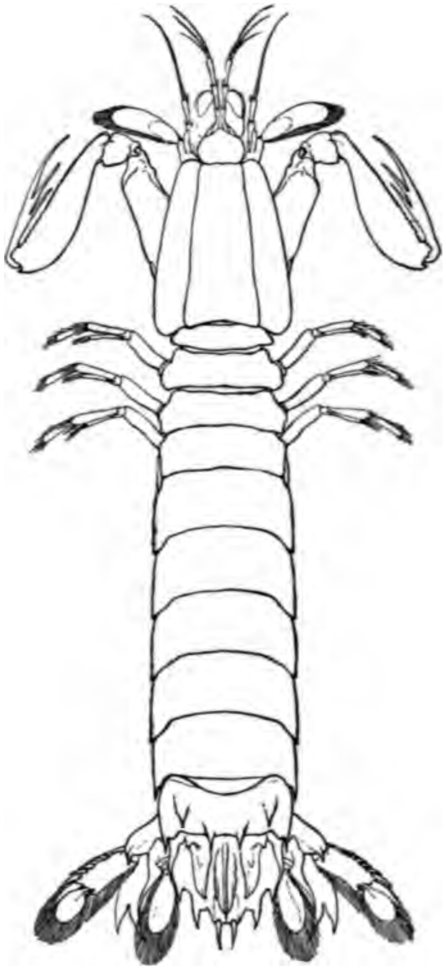


FIG. 3. *Pseudosquilla ciliata*, Miers, male, × 2; not accurately to scale.

G. œrstedii is readily distinguished from *G. spinosus* Bigelow and *G. spinosissimus* Pfeffer by the absence of prickles on the dorsal surface; and it is separated from *G. glabrous* Brooks and *G. graphurus* Miers by the possession of only three central longitudinal carinæ on the telson. There are small additional elevations on the telson at the bases of the intermediate denticles, in front and a little on one side of the submedian central prominences, behind the median prominence, and along the margins of the submedian and intermediate spines, fig. 1. In front of the median prominence are two small pits on very slight elevations of the surface and there are two grooves on the sides of the central prominence near its posterior end. The first antennæ are fairly long, the second joints extending beyond the eyes. The second pair extend nearly as far forward as first. The antennary scale slightly exceeds half the length of the carapace; the carapace is about one-fourth the length of the body. The appendages to the walking legs are linear. The basal prolongation of the uropod is broad and flat, and the two spines are curved inward. There is no tooth on the margin of either spine. The distal segment of the exopodite is about half the length of the proximal one, which bears 11 movable spines besides a small immovable terminal one.

Color.—The coloring is very variable, both in shade and pattern, and is distinctly protective; varying from a mottled green and white to a nearly pure olive green.

Size.—Length of full-grown specimens, about 5 cm.

Geographical distribution.—This species is common in the tropical Atlantic from the West Indies to Brazil, and is the only form of *Gonodactylus* reported from this region. In the waters of Porto Rico the *Fish Hawk* collected a large number of specimens from various stations on the eastern, southern, and western coasts in depths varying from 21 fathoms, at station 6089, west of the island of Vieques, to a few feet of water on coral reefs. The most numerous collections were made with tangle at station 6092, north of Vieques, depth 16 fathoms, coral bottom, and by shore collecting in Ensenada Honda, island of Culebra.

Life history.—The early larval stages of this species have been fully described and illustrated by Brooks ('92). The eggs are deposited in burrows excavated by the females in pieces of coral rock lying upon the sand flats. The larva hatches in an *Erichthus* form with very short eye-stalks and the sutures between the fifth and sixth and between the sixth and seventh abdominal somites undeveloped. The abdomen bears five pairs of appendages. The first molt occurs about sixty hours after hatching, and the second about a week later, when the larva passes into the typical form of the *Gonerichthus*. Before the second molt Brooks's larvæ remained near the bottom of the aquarium and fed upon the eggs of an unknown species of Nudibranch; but after the second molt they refused this food and swam at the surface. Suitable food for this stage not having been discovered, it was impossible to rear the larvæ further. Later stages were obtained, however, by collecting with the skimming net, and they are described in the memoir.

Genus PSEUDOSQUILLA (Guérin) Dana.

Diagnosis.—Stomatopoda with the sixth abdominal segment not fused to the telson; the hind body smooth, very convex, and narrow; the dactylus of the raptorial claw not dilated at the base and provided with not more than three lateral teeth; the submedian spines of the telson long and with movable tips; and not more than four intermediate denticles, usually one.

Larval form.—We are indebted to Claus for the determination of the larval form of this genus, to which Brooks ('86) has given the name *Pseuderichthus*. It may be recognized by the following characters: Eyes stalked, appendages I–VII and XIV–XVII present in the earliest stages, hind body very long; telson longer than wide, sometimes ovate in general outline; carapace narrow, at least twice as long as wide, short, without prominent ventro-lateral angles, short rostrum, and posterior lateral spines short, usually only one-fourth or one-third as long as the carapace, and placed near the dorsal median line.

Pseudosquilla ciliata Miers. (Figs. 3 and 4.)

? *Squilla ciliata*, Fabricius, Ent. Syst., II, p. 512, 1793.

Squilla stylifera, Lamarck, Hist. Anim. sans Vert., V, p. 189, 1818. Latreille, Encyl. Meth., X, p. 472, 1825.

Pseudosquilla stylifera, Dana, U. S. Expl. Exp., XIII, Crustacea, I, p. 622, 1852. ? Von Martens, Arch. f. Naturg., XXXVIII, p. 146, 1872.

Pseudosquilla ciliata, Miers, Squillidæ, Ann. and Mag. Nat. Hist., (5), V, p. 108, 1880. Brooks, Voyage of *Challenger*, XVI, p. 53, 1886. Bigelow, Stomatopoda collected by the steamer *Albatross*, Proc. U. S. Nat. Mus., XVII, p. 499, 1894. Hansen, Isopoden, Cumaceen, und Stomatopoden, Engeb. Plank. Exp., II, G. c., p. 86, 1895. Rankin, Crustacea from the Bahamas, Ann. N. Y. Acad. Sci., XII, p. 253, 1898.

Diagnosis.—A *Pseudosquilla* with cylindrical eyes; the dactylus of the raptorial claw slender with three teeth, including the terminal one; a smooth rostrum without spines or acute angles, wider than long; lateral margins of the exposed thoracic segments slightly produced, the first acute, the others more or less rounded, the second obliquely truncated, and the fourth notched; the first five abdominal segments smooth and without carinæ or spines, except posterior-lateral spines on the fourth and fifth segments; sixth segment with 6 strong spines, the intermediate pair arising farther forward than the others, about half way between the anterior and posterior margins; a high, narrow crest ending in a spine and 6 other carinæ on the telson, one pair on the lateral margins, and two pairs grouped near the crest, the pair nearest the crest being the smaller; 6 marginal spines, the submedian pair long and mobile; 2 simple spines on the basal prolongation of the uropod, of which the inner one is the longer; 8 to 10 mobile spines on the exopodite.

General description.—The specimens in the collection from Porto Rico differ from Miers's description in that the posterior margin of the carapace is not straight, but distinctly concave, and in having minute posterior lateral spines on the fourth as well as the fifth abdominal somite. In his figure the basal prolongation of the uropod is represented as extending as far as the tip of the exopodite, and the endopodite appears to equal the proximal segment of the exopodite in length. In our specimens the basal prolongation extends only so far as the tip of the endopodite, which, however, is considerably longer than the proximal segment of the exopodite. (In fig. 4 the basal prolongation is represented as a little too long, and the spines should be more slender and less sinuous on their inner margins.) The distal segment of the exopodite is less than two-thirds the length of the proximal one. Brooks found these segments to be equal in specimens from the Pacific, but the distal one shorter in specimens from St. Thomas. He found also that the posterior lateral angles of the fourth abdominal segment were rounded and without spines in specimens from the Pacific. His specimens from St. Thomas differed from those from Honolulu in having the spines of the basal prolongation of the uropod equal in length. But our specimens from Porto Rico agree with those from the Pacific in having the inner spine the longer. As Brooks has pointed out, this species probably varies to a considerable extent, and the slight differences observed do not furnish sufficient ground for dividing it. *P. ciliata* is distinguished from *P. ornata* Miers by its cylindrical eyes, the eyes of *P. ornata* being flattened and club-shaped. It is separated by the number of carinæ on the telson from all other species having a similar basal prolongation to the uropod.

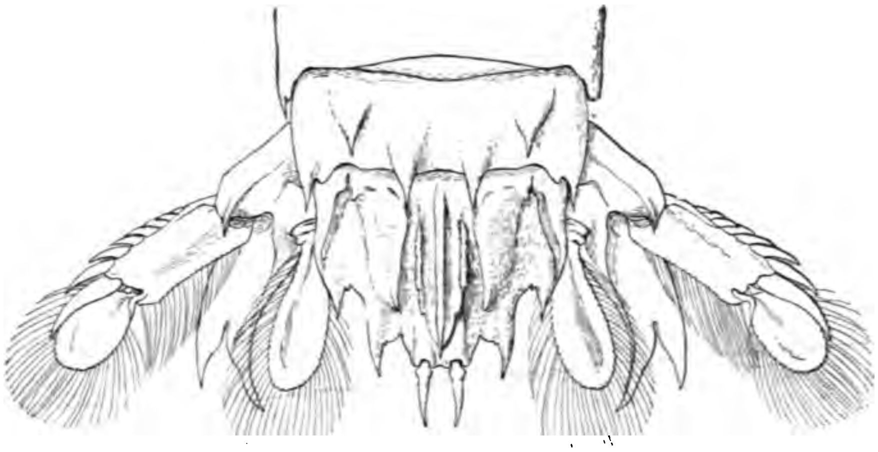


FIG. 4. Telson and adjacent parts of *Pseudosquilla ciliata.* Same specimen as Fig. 3. ×4.

Color.—Living specimens observed at Bimini (Bigelow, '94) showed great variation in coloring, which closely resembled that of *Gonodactylus œrstedii.*

Size.—The largest specimen in the present collection measures 8 cm. in length.

Geographical distribution.—This is perhaps the most widely distributed of all the Stomatopods. It is common in the West Indies, living on shoals of coral sand associated with *Gonodactylus œrstedii,* and is found also at the Cape Verde Islands. In the Indo-Pacific region it has been taken from the Red Sea, Mauritius, Ceylon, Japan, and from various localities in the Malay Archipelago, South Sea Islands, and Hawaii. On the Porto Rico expedition the *Fish Hawk* obtained specimens in San Juan Harbor, Ensenada Honda in Culebra, Mayaguez Harbor, Boqueron Bay, Fajardo, Playa de Ponce, and at several stations in the shallow sound between St. Thomas, Culebra, and Porto Rico by dragging the tangle over the coral bottom. The greatest depth was 20 to 23 fathoms, at station 6079, off St. Thomas.

Life history.—Hansen ('95) identifies the larval form of this species under the name *Pseuderichthus communis.* In the earlier stages it can not be distinguished from the very similar larva of *Pseudosquilla oculata* Brulle (*Pseuderichthus distinguendus* Hansen). But when fully developed it may be recognized by its smaller size, 21 to 24 mm., and the possession of 8 distinct spines on the uropod (Hansen, l. c., pl. VIII, fig. 5). *P. distinguendus* of this size does not have the upper spines of the uropod distinct. When fully developed this species is longer than *P. communis*—over 24 mm.—and has 10 to 11 of these spines.

Between this stage and the adult form there is an intermediate stage (Claus, '71, figs. 26 and 27*c*). We might call it the *monodactyla* stage, for, according to Hansen, *Pseudosquilla monodactyla* of Milne-Edwards is this stage of *P. oculata.* The carapace has lost the larval spines and the whole appearance of the animal is very much like the adult *Pseudosquilla;* but on the dactylus of the raptorial claw only the rudiments of the two lateral teeth may be seen beneath the integument, and the telson has only the median carina, the others not being developed. In our specimens, however, there are slight elevations on the telson representing the lateral marginal and external pair of central carinæ. Hansen has two specimens of this stage of *P. ciliata* that measure from the tip of the rostrum 17.5 and 21.3 mm. In the present collection there are five specimens in this stage from three localities. They were taken in Ensenada Honda in Culebra, San Juan Harbor a quarter of a mile from Morro Castle with the dredge at a depth of 4 to 7½ fathoms, and at station 6092 between Culebra and Vieques with the tangle at a depth of 16 fathoms. These specimens have the following lengths, 16, 17.5, 17.5, 19, 19 mm. Three of them have 9 mobile spines on the uropod and two have 8.

It is probable that at the next molt these would pass into the adult form, and that the growth at that time results in a thickening of the body rather than in increase in length. In fact, there seems to be a slight shortening of the body, for in the collection there are five small specimens of the adult form measuring 16, 17, 17, 17.5, and 17.5 mm., respectively, but their bodies are much thicker and more strongly built than the larvæ in the *monodactyla* stage. One of these has 8 mobile spines on the uropod; the others have 9.

Genus LYSIOSQUILLA Dana.

Diagnosis.—"Stomatopoda having the sixth abdominal segment separated from the telson by a mobile joint; the hind-body depressed, loosely articulated, and wide; the dactylus of the raptorial claw without a basal enlargement and with not less than five marginal teeth; no more than 4 denticles, often only 1, between the intermediate and submedian marginal spines of the telson, which is usually wider than long."

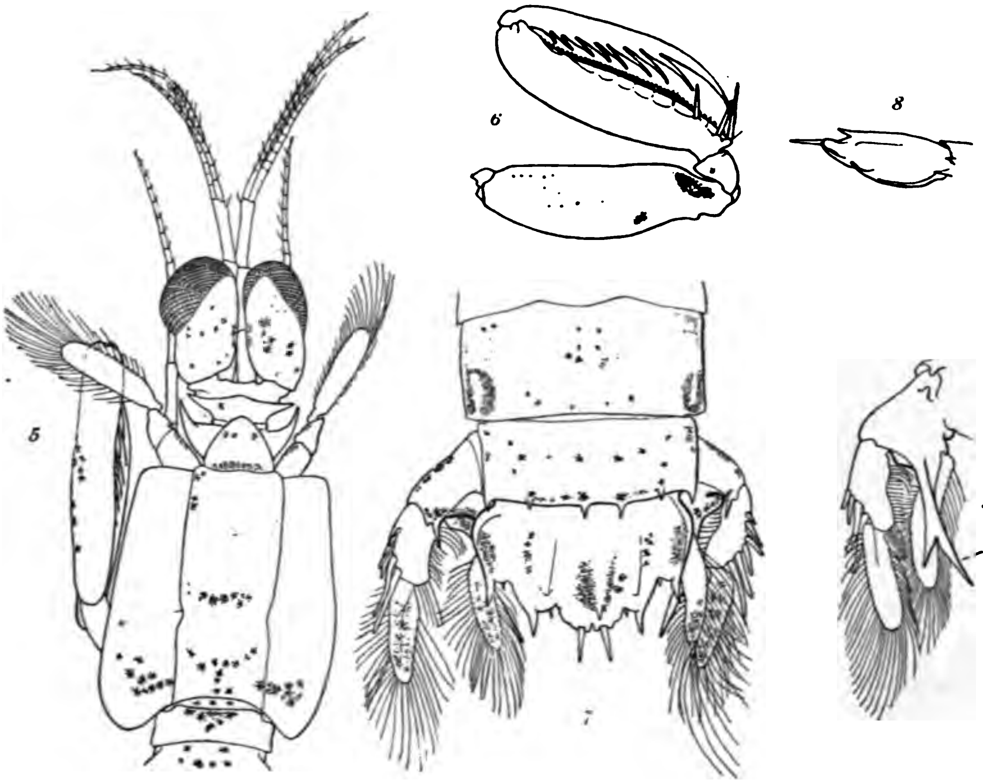
Larval form.—A *Lysioerichthus*, Brooks, having stalked eyes, appendages I–VII and XIV–XVII present in earliest stages; telson wider than long, with never more than four intermediate denticles; body short; carapace large and wide, infolded on the ventral side, with prominent ventral angles, and posterior lateral angles widely separated from the median line; hind-body wide and flat.

Lysiosquilla plumata, sp. nov. (Figs. 5 to 9.)

Provisional diagnosis.—A *Lysiosquilla* having the corneal portion of the eye nearly globular and set obliquely upon the strong, nearly cylindrical eye-stalk; the dactyli of the raptorial claws with nine marginal teeth, including the terminal one; antennary scale small, less than half the length of the carapace; appendages to the walking legs linear; the rostrum shorter than wide, triangular, with rounded apex, hardly overlapping the ophthalmic segment; the carapace smooth, nearly quadrate, without acute angles, posterior lateral lobes slightly produced backward; the hind-body smooth; 6 marginal spines on the sixth abdominal segment, the intermediate pair arising slightly in front of the margin; the telson wider than long, convex above with 3 dorsal carinæ, of which only the middle one ends in a posterior spine, narrow lateral marginal carinæ, 6 marginal spines, submedian pair long and mobile, the other pairs shorter and curved slightly upward, no submedian denticles, 1 intermediate and 1 lateral one on each side, arising from the ventral surface of the telson and partially covered above by a broad lobe of the margin; uropods with a very narrow basal prolongation, angled on the ventral side, without serrations, and terminating in 2 stout spines, of which the inner one is the longer; and 7 mobile spines on the uropod, the distal one not much more than half the length of the paddle.

Remarks.—It is not possible to give more than a provisional description of this species at present, because the only material available is one very small male specimen. It is very probable that full-grown individuals will be found to differ from this specimen in important details. This is especially probable in regard to the female, for sexual dimorphism is not uncommon in other species of the genus. Nevertheless, the form here described differs so clearly from any previously described species of *Lysiosquilla* that it seems worth while to place it upon record. The most nearly related species are *Lysiosquilla spinosa* Wood-Mason and *L. maiaguesensis* n. sp. It differs from the former in the absence of spines on the submedian dorsal carinæ of the telson, in having the mobile spines of the telson longer than the others, and in having no submedian and only one intermediate denticle. (Fig. 7.) The differences from the latter will be discussed when we come to that species.

L. plumata is not identical with *L. tricarinata* (Gray), White ('47), for according to Miers ('80) that species has about a dozen minute intermediate denticles.



FIGS. 5-9, *Lysiosquilla plumata*. Male, camera drawings, ×11⅓. Fig. 5, head and carapace. Fig. 6, right raptorial claw. Fig. 7, last three abdominal segments. Fig. 8, side view of telson. Fig. 9, right uropod viewed from ventral side; *bp*, basal prolongation.

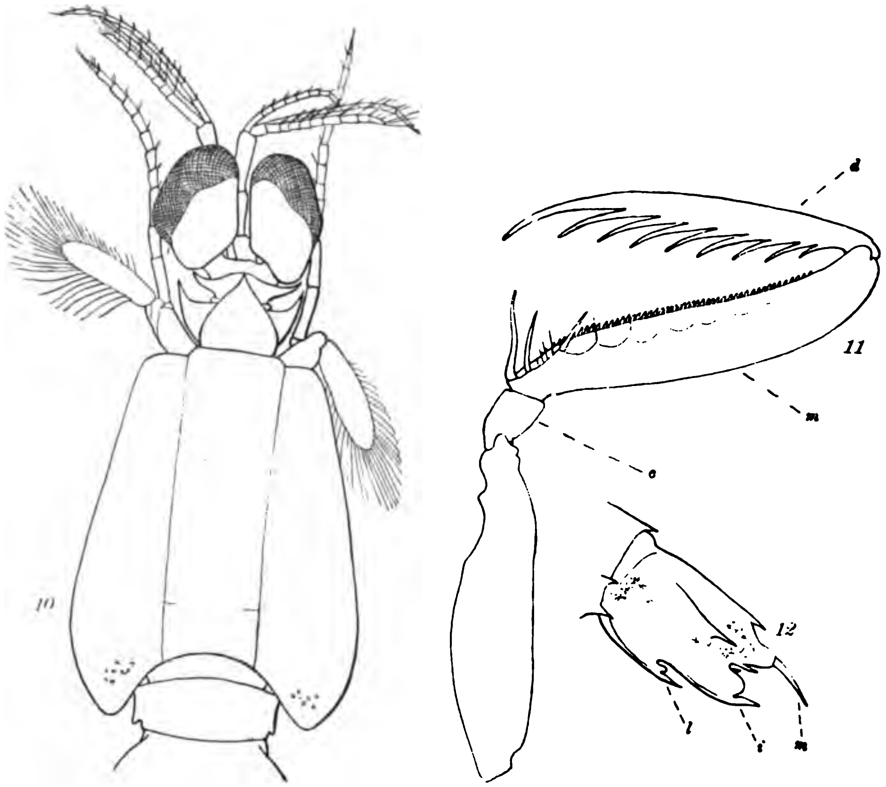
Color.—The color pattern is indicated in the alcoholic specimen by the presence of dark branching pigment cells. There is an eye-spot at each posterior lateral angle of the fifth thoracic segment, a dark spot on the two sides of the central carina of the telson, and accumulations of pigment on the sides of the telson, the terminal segments of the uropod, the posterior lobes of the carapace, and at the base of the rostrum. More scattered pigment cells indicate a symmetrically mottled pattern covering the whole dorsal surface. (Figs. 5 and 7.)

Size.—The specimen in hand has the following dimensions: Total length, 15.0 mm.; length of carapace on mid-line, 2.8 mm.; width of carapace, 2.6 mm.; width of fifth abdominal segment, 3.0 mm.; length of telson, 1.4 mm.; length of antennary scale, 1.2 mm.

Locality.—One male specimen was taken by the *Fish Hawk* at station 6062 in Mayaguez Harbor, Porto Rico, using the dredge on a bottom of sand, mud, and shells, at a depth of 25 to 30 fathoms.

Lysiosquilla maiaguesensis, sp. nov. (Figs. 10 to 13.)

Provisional diagnosis.—A *Lysiosquilla* having triangular eyes, the corneal axis oblique and shorter than the peduncular one; raptorial claws with a slender dactylus bearing 8 to 10, usually 9, marginal teeth; small antennary scales, less than half the length of the carapace; appendages to the walking legs linear; the apex of the broadly ovate rostrum acute; a smooth carapace slightly narrowed in front, with rounded angles, the posterior lateral angles being produced backward as broad lobes; the hind-body depressed and smooth, except for very narrow lateral marginal carinæ on the first five abdominal segments, and six spines on the posterior margin of the sixth abdominal segment, the intermediate pair being continuous with low carinæ; the telson wider than long, convex, with 3 dorsal carinæ ending posteriorly in spines, narrow lateral marginal carinæ, 6 marginal spines, of which the submedian pair are long and mobile, the intermediate ones large, extended downward below the ventral surface of the telson, and with a large rounded lobe on the dorsal side, lateral pair smaller, similarly curved and lobed; no submedian denticles, 2 intermediate and 1 lateral one on each side arising from the margin; about 12 fine sharp serrations on the inner margin of the broad basal prolongation of the uropod, of which the inner tooth is much the longer; and 6 mobile spines on the exopodite, the distal one extending to or beyond the tip of the paddle.



FIGS. 10–12. *Lysiosquilla maiaguesensis.* Male, camera drawings, × 11. Fig. 10, head and carapace. Fig. 11, left raptorial claw: *c*, carpus; *d*, dactylus; *m*, manus. Fig. 12, side view of the telson, × 11: *m*, submedian spine; *i*, intermediate spine; *l*, lateral spine.

Remarks.—Unfortunately, the material is too scanty to allow more than a provisional description of this species, 2 small males being all that is afforded by the collection. It is closely related to the preceding, but differs from it in a number of striking peculiarities. The first pair of antennæ are shorter, the eyes are larger, the rostrum is as long as it is broad, and acute. (Compare figs. 5 and 10.) But the most remarkable differences are to be found in the telson and the uropods. (Compare figs. 12 and 13 with figs. 7, 8, and 9.) The telson differs not only in being longer and having three dorsal spines, but to a greater degree in the form of the marginal spines and the mode of origin of denticles.

In the uropods the basal prolongation has an entirely different form, and the segments of the limb show marked dissimilarities of shape and proportion. It will be noted that in the form of the telson this species closely approaches the genus *Pseudosquilla*.

Color.—In the alcoholic specimens there is a well-marked band of pigment on each side extending the whole length of the hind-body. These bands are connected by fine transverse lines at the posterior margin of each segment. The lobes of the carapace and the posterior part and sides of the telson are also pigmented.

Size.—The two male specimens have the following dimensions in millimeters:

	No. 1.	No. 2.
Total length	18.5	22.5
Length of carapace on mid-line	3.5	4.0
Length of telson	2.0	2.1
Width of carapace	3.4	4.2
Width of fifth abdominal segment	3.5	4.5

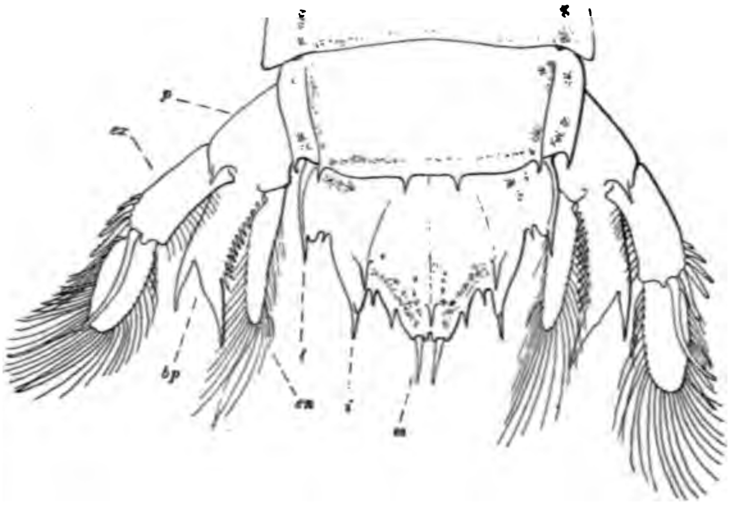


FIG. 13. Telson and adjacent structures of *Lysiosquilla maiaguezensis*. Male, camera drawing, × 11: *bp*, basal prolongation of the uropod; *en*, endopodite; *ex*, exopodite; *p*, protopodite; *m*, submedian spine of the telson; *i*, intermediate spine; *l*, lateral spine.

Locality.—The *Fish Hawk* took three small specimens (one mutilated) at station 6066 in Mayaguez Harbor, with the beam trawl, on a sand and mud bottom, at a depth of 161 to 172 fathoms.

Life history.—Unknown.

Genus SQUILLA Fabricius.

Diagnosis.—"Stomatopoda having the telson attached to the sixth abdominal segment by a mobile joint; the hind-body depressed and wide; the dactylus of the raptorial claw with usually not more than 6 teeth; as a rule more than 4 intermediate denticles on the telson, which is usually longer than wide; and the inner basal spine of the uropod the longer of the two."

Larval form.—An *Alima*, Leach, having stalked eyes; appendages I to VII and XIV to XVII present in earliest stages; a telson generally octagonal in general outline with numerous intermediate denticles; the inner basal spine of the uropod longer than the outer; the body greatly elongated; carapace flattened, elongated, and narrow (width usually about one-fourth the length); usually several thoracic segments exposed.

Squilla intermedia Bigelow.

Squilla intermedia Bigelow, Johns Hopkins Univ. Circ. 88, 1891; Proc. U. S. Nat. Mus., XVII, p. 530, fig. 19.

Diagnosis.—A *Squilla* having very large, nearly T-shaped eyes; very large and strong raptorial claws, with 6 teeth upon the dactylus; the rostrum narrowed in front and provided with well-marked median and lateral carinæ; 5 strong carinæ on the carapace, the median one bifurcated in front and behind, and the lateral one ending in spines at the anterior lateral angles; posterior lateral margin angled; the lateral margin of the fifth thoracic segment produced into a strongly sickle-shaped acute spine; of the sixth and seventh obliquely truncated and very acute; 8 prominent carinæ on the abdominal segments, all ending in spines except the submedian of the first 4 segments; a low crest on the telson, ending in a small spine, a post-anal keel without a spine, the dorsal and ventral surfaces of the telson marked by numerous curved lines of very fine pits, 6 marginal spines, and 4 to 6 submedian denticles, 10 to 13 intermediate, and 1 lateral one; the crest and dorsal margin of the telson very much thickened in the male; the marginal thickening being continuous between the intermediate spines.

Remarks.—This species stands in an intermediate position between two Pacific forms, *S. panamensis* Bigelow and *S. biformis* Bigelow, from both of which it may be distinguished most easily by the character of the thickening of the telson in the males. This feature, as well as the number of denticles, serves also to distinguish full-grown specimens from the nearest Atlantic form, *S. empusa* Say. The latter has 3 to 5 submedian denticles, 6 to 10 intermediate, and 1 lateral one; and never has any thickening of the carinæ on the abdomen or of the margin of the telson, either in males or females.

In the Porto Rico collection there are 4 young males, the largest 5.55 cm. and the shortest 2.25 cm. in length, which seem to be *S. intermedia*, although they differ from the type specimens in some particulars. The antennary scales are only one-half instead of three-quarters the length of the carapace; the margins of the sixth and seventh thoracic segments (the second and third exposed ones) are not acute, but rounded at the apex, and bear an anterior lobe well marked in the sixth and minute in the seventh; in 3 of the specimens the marginal carinæ of the first and second abdominal segments are the only ones on those segments that bear spines; the denticles on the telson are 3–4, 8–9, 1; and the expodite of the uropod bears 9 mobile spines. In the largest one of these specimens there are, however, thickenings of the margin of the telson that suggest the beginnings of the structure characteristic of the type. When we remember that this species was described from only two specimens, a male and a female, and that the specimens under consideration are evidently immature, it would seem better to regard them as all of one species, pending further study of the fully adult form and the younger stages.

Size.—The largest of the type specimens was 10.5 cm. in length.

Locality.—Gulf of Mexico and tropical Atlantic. The specimens collected by the *Fish Hawk* were all taken in Mayaguez Harbor with the beam trawl, at 7¼ to 18 fathoms, on a mud bottom.

Life history.—Unknown.

THE MORE IMPORTANT LITERATURE ON STOMATOPODA.

BIGELOW, R. P., '94. Report upon the crustacea of the order Stomatopoda collected by the steamer *Albatross* between 1885 and 1891, and on other specimens in the U. S. National Museum. Proc. U. S. Nat. Mus., XVII, pp. 489–550. 1894.

BORRADAILE, '98. On some crustaceans from the South Pacific. Part 1. Stomatopoda. Proc. Zool. Soc. Lond. 1898, pt. 1, pp. 32-38, pl. V–VI.

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REPORT ON PORTO RICAN ISOPODA.

BY

H. F. MOORE.

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The Isopoda collected in Porto Rico by the *Fish Hawk* during January and February, 1899, include but seventeen species, but the collection is interesting in furnishing two new genera, one of considerable interest, and eight species apparently not before described. In all, eleven families and fifteen genera are represented. They are as follows:

Tribes.	Families.	Genera and species.
Chelifera	Apseudidæ	Apseudes espinosus, n. sp.
	Tanaidæ	Leptochelia incerta, n. sp.
Flabellifera	Cirolanidæ	Cirolana mayana Ives.
		parva Hansen.
		obtruncata Richardson
		Branchuropus littoralis, n. gen. and sp.
	Corallanidæ	Corallana tricornis Hansen.
	Alcironidæ	Alcirona hirsuta, n. sp.
		Nalicora rapax, n. gen. and sp.
	Ægidæ	Æga ecarinata Richardson.
		Rocinela signata Schiödte & Meinert.
	Cymothoidæ	Anilocra laticauda Milne-Edwards.
	Sphæromidæ	Cilicæa caudata Ives.
		Dynamene perforata, n. sp.
Valvifera	Idoteidæ	Cleantis planicauda Benedict.
Oniscoidea	Ligiidæ	Ligia gracilis, n. sp.
	Oniscidæ	Philoscia culebræ, n. sp.

All of these are littoral or shoal-waters species, none of them being taken in water deeper than 75 fathoms.

*Key to tribes and families of Porto Rican Isopoda.**

a. Head united with first segment of thorax; first pair of thoracic limbs chelate; pleopods not branchial, sometimes absent .... Tribe CHELIFERA

b. First antennæ biflagellate; second antennæ with multiarticulate flagellum .... APSEUDIDÆ

bb. First antennæ uniflagellate (flagellum obsolescent in female); second antennæ without scale, flagellum small .... TANAIDÆ

aa. Head and first thoracic segments not united; first pair of thoracic limbs not chelate; pleopods, all, or some, branchial.

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* Key in part from Stebbing after Hansen.

c. Telson and uropods forming a caudal fan (except in *Branchuropus*) .... Tribe **FLABELLIFERA**

  d. Pleon consisting of six free segments; uropods with both branches freely articulated with peduncle.

    e. Maxilipeds with the "palp" free, the margins of the last two joints more or less setose, never furnished with hooks.

    First maxillæ with the plate of the third joint tolerably broad, at least toward the middle.

      f. Mandibles with the distal half stout, very conspicuous, uncovered, or with only the anterior margin concealed; from the base toward the middle directed forward and a little outward.

        g. Mandibles with the rather broad, more or less tridentate cutting edges meeting squarely behind the large upper lip; the secondary plate and peculiar equivalent for the molar well developed.

        First maxillæ having the plate of first joint armed with three spines, that of third with many.

        Second maxillæ of moderate size, the three free plates very setose.

        Maxillipeds with the "palp" rather broad, very setose .... **CIROLANIDÆ**

        gg. Mandibles with the distal part produced into a long prominent process, the pair much overlapping; the secondary plate and molar evanescent.

        First maxillæ having the plate of first joint unarmed, of the third carrying one very long spine.

        Second maxillæ small and feeble, the free plates almost rudimentary with few setæ.

        Maxillipeds with "palp" narrowed, not very setose (the antepenultimate joint rather elongate) .... **CORALLANIDÆ**

      ff. Mandibles with the distal half narrow, most or all of it concealed by the upper and lower lips; from the base toward the apex directed gradually inward.

      First maxillæ having plate of first joint unarmed, of third carrying two spines or only one.

      Second maxillæ feeble, sometimes very small, with one plate or none, the setæ very few or none.

      Maxillipeds with the "palp" rather broad, with no elongate joint .... **ALCIRONIDÆ**

    ee. Maxillipeds with the "palp" embracing the cone formed by the distal parts of mouth organs, the inner upper margin and apex never setose, the apex and sometimes the inner upper margin, at least in the males and the females without eggs, being furnished with outward-curved hooks.

    First maxillæ with the plate of the third joint narrow throughout.

    Distal parts of the mouth organs forming a short subvertical cone.

    Second maxillæ large, elongate, and proportionately broad, with two apical plates furnished with hooks.

    Maxillipeds with the fourth and fifth joints sometimes coalesced, never forming a long joint.

      h. Mandibles with the secondary plate very often (perhaps always) visible; the "palp" with no inflated joint.

      Maxillipeds commonly 7-jointed, sometimes 4-jointed, the last joint in the latter case rather short, obtuse .... **ÆGIDÆ**

      hh. Mandibles with no secondary plate; the "palp" in the adults with the first joint or both first and second joints inflated.

      Maxillipeds always four-jointed, the last joint rather long and narrow, subacute .... **CYMOTHOIDÆ**

  dd. First five segments of pleon fused; one branch of uropods immovably fused with peduncle...... **SPHÆROMIDÆ**

cc. Uropods folding beneath the pleon to cover the pleopods .... Tribe **VALVIFERA**

  Only family represented .... **IDOTEIDÆ**

ccc. Uropods terminal, various, sometimes filiform or conical, sometimes valvate, but never covering more than the last two segments of abdomen below. First antennæ with three short joints, or fewer, or wanting .... Tribe **ONISCOIDEA**

  i. First maxillæ with three setæ on inner plate. (In the one genus from Porto Rico the second antennæ multi-articulate) .... **LIGIIDÆ**

  ii. First maxillæ with two setæ on inner plate. (In the one genus from Porto Rico the second antennæ tri-articulate .... **ONISCIDÆ**

Tribe CHELIFERA.

APSEUDIDÆ.

Apseudes espinosus, new species.

Cephalothorax short, less than length of first 3 segments of thorax, slightly wider than long; rostrum short, produced to a mere point; eye-stalks short, projecting but slightly beyond sides of head. First 3 segments of thorax subequal to one another in length and breadth, approximately equal to head in breadth. Last 3 segments narrower; fourth segment longer than segments 2 and 3 combined; fifth free segment about equal to them; sixth segment about three-fourths as long as fifth. Epimera of first 3 segments not evident, none of the segments with lateral spines; epimera of last 3 segments small, in dorsal view projecting slightly from beneath each segment near its articulation with its successor. Abdomen narrower than last segment of thorax, but not abruptly so; the first 5 segments equal in length and successively slightly narrower; collectively about as long as sixth thoracic segment; lateral margins rounded, somewhat produced posteriorly. Telson about as broad as long, slightly narrower than fifth segment of pleon, bilobate posteriorly.

Peduncle of antennule as long as head, first joint stout, longer than other 3 joints combined, second joint not half as long as first, 2 following joints successively shorter; 2 flagella of equal length, and longer than peduncle, the outer somewhat stouter, with 17 joints, inner flagellum with 15 joints.

Antennæ about two-thirds as long as antennules; peduncle short, consisting of 5 joints, first and second joints stout, second furnished with a scale beset with long setæ, last 3 joints short. Flagellum about as long as flagella of antennule, consisting of 13 setiferous joints.

Mandibles stout, with a 5-dentate cutting edge and a 3-jointed palp. First maxillæ tipped with a number of stout brown spines. Maxillipeds with a stout 4-jointed palp, of which the second joint is very large and stout.

Details in relation to the oral parts are not known, as there was but one specimen, mounted in balsam and not dissected.

The chelipeds in the female are long and slender, the fifth joint being the longest and the second almost as long, but stouter. The third joint is prolonged distally into a curved process furnished with 5 or 6 long hairs on the convex margin; the sixth joint, with the seventh, constituting a slender chela; no molar tubercles; curved margin of "thumb" of sixth joint with a row of slender bristles; a row of blunt spines on cutting edge.

The second pair of limbs have the joints stout and furnished with strong spines. The second joint or basis has 5 or 6 stout curved spines on its outer margin. It is longer than the other joints. The terminal claw is flanked on each side by a strong spine attached to sixth joint. There appear to be but 5 free joints to this and the following limbs, but this appearance may be due to defects in the mounting; following pairs of limbs more slender, the last pair having a second joint almost as long as all the rest, and with an oblique row of small spines near distal end of posterior face of sixth joint.

There are 5 pairs of pleopods, with both branches 1-jointed.

Uropods biramous, the inner ramus with about 50 joints; outer ramus less than one-half as long, with about 25 joints. The joints of both are of irregular length.

One specimen, female, from station 6079, 20 fathoms, 6 mm. by 1.4 mm.

TANAIDÆ.

Leptochelia incerta, new species.

Body of female elongate, about five times as long as broad, slightly narrower in posterior part of thorax.

Head narrower in front, at base of eyes about two-thirds of greatest width, about 1.2 times as long as broad, length about equal to first 3 thoracic segments, slightly produced between bases of first antennæ. The first 3 segments of thorax subequal, last 3 about one-third longer and subequal. Abdomen about 2.5 times as long as last thoracic segment, than which it is slightly broader; first 4 segments about equal to one another, the fifth segment slightly longer, the sixth or terminal segment longest, rounded posteriorly with a blunt process in the median line.

Eye-stalks well developed, nearly as wide as bases of first antennæ, by which they are partly concealed in dorsal view; first antennæ 4-jointed, first joint stout, much longer than other three, second and third joints equal, fourth joint rudimentary, somewhat obliquely attached to third and furnished with about 3 long bristles, third joint also furnished with bristles at its distal end; second antennæ about as long as basal joint of first antennæ, 5-jointed, fourth joint longest, about equal to second and third joints together, second joint with a stout spine on inner distal angle. Mandibles with a tridentate cutting edge and a large molar process; first maxillæ terminated by a tuft of strong spines, palp with 2 long setæ; maxillipeds with large basal joint and a well-developed, strongly setiferous palp. Chelipeds stout, with 5 free joints; ventral margin of penultimate joint not strongly curved at base; thumb rather short, measured from base of dactylus about three-fourths the width of propodus; second thoracic limbs with the ultimate joint somewhat longer than the penultimate the claw slender and curved; next 2 pairs shorter and stouter, claw short; last 3 pairs also shorter, the joints furnished with a few short spines.

Pleopods, 5; uropods biramus; the inner ramus 1-jointed, shorter than first joint of outer ramus, with a terminal tuft of setæ; outer ramus 5-jointed, fifth joint longest, but shorter than peduncle of uropod.

Arroyo, one specimen; Culebra, one specimen. Length, female, 3.8 mm.; width, 0.8 mm.

This species is distinguishable from *L. savignii* by the greater proportional length of the dactylus, the proportional length of the head, and the segments of the thorax, the shape of the last abdominal segment, the form of the chelæ, and by its greater size. It may possibly be the female of *L. rapax* Harger, of which I have seen no specimens, but is considerably larger than Harger's specimens.

Tribe FLABELLIFERA.

CIROLANIDÆ.

Key to Porto Rican genera and species.

a. Uropods normal, forming with telson a caudal fan, inner angle of peduncle produced; maxillipeds with 5-jointed palp; peduncle of second antennæ 5-jointed; first pleopods not opercular .... *Cirolana.*
  b. About first 10 joints of second antennæ each with 2 tufts of setæ projecting forward, the whole forming a brush on anterior edge. Clypeus with a prominent obtusely pointed spine on anterior margin.. *C. mayana* Ives.
  bb. Without brush-like rows of setæ on second antennæ. No spine on clypeus.
    c. Apex of telson rounded, uropods subbifid; flagellum of first antennæ 11 or 12 jointed .... *C. parva* Hansen.
    cc. Apex of telson broadly truncate; the uropods rounded at ends; flagellum of the first antennæ 8-jointed .... *C. obtruncata* Rich.
aa. Uropods resembling the pleopods and concealed beneath telson, peduncle slender; maxillipeds with 1-jointed palp; peduncle of second antennæ 4-jointed; first pleopods not opercular .. *Branchuropus*, new genus.
  Only species .... *B. littoralis*, n. sp.

Cirolana mayana Ives.

Body elongate-ovate, about 2.5 times as long as broad, strongly convex. Front produced to a triangular deflexed process united in front of first antennæ with the quadrate reflexed portion of epistome. Head to base of rostrum about 2.5 times as broad as long, front on each side of median process nearly straight.

First segment about as long as head, fifth and sixth almost as long, rest of segments shorter.

First abdominal segment entirely and the second partly concealed dorsally, the next three equal, the third laterally concealed by the seventh thoracic segment. Telson about one-fourth broader than long, subtriangular, lateral margins curved, tip with short setæ, a strong depression on each side of lateral line near base.

Eyes occupying entire lateral margin of head, first antennæ reaching to the middle of second segment, with a 10 to 12 jointed flagellum, last joint of peduncle with a row of bristle-like setæ on posterior margin. Second antennæ about twice as long as first, reaching to end of third segment, with a 5-jointed peduncle and a flagellum of from 21 to 24 articuli, the first 10 joints (about) short and broad and furnished with 2 rows of close-set setæ near the anterior or outer margin, constituting an outwardly projecting brush.

Epistome subtriangular, sides slightly incurved, expanded and dorsally reflexed in front of second antennæ, and uniting with frontal process. Clypeus with a strong, blunt process projecting downward and forward to between bases of second antennæ. Mouth parts as usual in the genus.

Thoracic limbs and pleopods not peculiar. Uropods reaching beyond end of telson, outer ramus the longer, with two blunt spines near tip and two on inner margin; inner ramus more than half as broad as long, its outer border emarginate, posterior and inner borders with about five spines; outer border of external ramus naked, inner and posterior borders setiferous; almost entire border of inner ramus setiferous; peduncle with a few long setæ on internal angle and several spines at base of outer ramus beneath.

Specimens from Boqueron Bay and Culebra. Largest, 12.5 by 5.1 mm; smallest, 5.8 by 2.2 mm.

Cirolana parva Hansen.

Body elongate-ovate, between 2.5 and 2.75 times as long as broad. Head broad and produced in front in a slender process between the bases of first antennæ, deflexed and uniting with the epistome.

First segment of thorax longest, the next five subequal, the last shortest.

First segment of pleon hidden, the second sometimes partially so, the fifth longest, hidden at sides by the lateral angles of the fourth.

Telson broad, subtriangular, dorsally uniformly convex; tip rounded and furnished with about eight spines.

First antennæ reaching to about end of head, in situ, about as long as peduncle of second antennæ, flagellum about 11 to 12 jointed. Second antennæ reaching to fifth segment, flagellum 25 to 32 jointed. Epistome pentagonal, about 1.5 times as long as broad, without spine or process. Clypeus without process on anterior margin. Fourth joint of second and third pairs of the thoracic limbs slender. Uropods short, reaching hardly to end of telson. Rami subequal, narrow at ends, bifid, their margins furnished with spines and a few short setæ.

Specimens from Mayaguez, Puerto Real, Boqueron Bay, Ponce, Arroyo, Culebra, and station 6079, 20 fathoms. Largest, 8.5 by 3.3 mm.; smallest, 4.6 by 1.3 mm.

Cirolana obtruncata Richardson.

Body broad and short, hardly 2.25 times as long as broad; head about twice as broad as long, front produced in middle line into an acute process between the bases of first antennæ; first antennæ slightly longer than peduncle of second antennæ, peduncle 2-jointed, flagellum 8-jointed; peduncle of second antennæ 5-jointed, flagellum broken, longest piece with 12 joints.

Epistome pentagonal, about 1.5 times as long as broad, uniting with decurved tip of frontal process. Mouth parts as usual in the genus; maxillipeds with a 5-jointed palp.

First segment of thorax about as long as head, the following six about two-thirds as long, and equal to one another; fourth, fifth, and sixth joints about equal to one another in width; first segment not produced posteriorly, but projecting forward at sides to embrace the eye laterally; the epimeron of second segment slightly produced, but rounded, the following segments successively more produced, more actually angled and broader, the last reaching to almost posterior dorsal border of fourth abdominal segment. All but the second epimeron can be seen in dorsal view.

The thoracic limbs are short and stout; the seventh joint is strong and curved, in the second and third pairs of legs equal to the sixth joint, and in the other pairs almost equal to it.

The first abdominal segment is narrow and hidden at the sides by the last thoracic segment; the next two joints are about equal in length and with their lateral margins produced, the posterior angle of the third embracing the fourth, notched ventrally to embrace base of caudal peduncle and reaching beyond the base of the telson; fourth joint produced laterally and covering the sides of the fifth and the lateral margin of base of telson. Fifth segment longest, first shortest, the rest equal. Telson nearly three-fourths as long as broad, lateral borders nearly straight, broadly truncate behind, the posterior border with about 6 short spines and a number of stout setæ.

Peduncle of uropods with inner angle produced; inner lamella broad, rounded behind, reaching to about end of telson, its margin armed with short spines and furnished with short setæ; outer lamella with its inner and outer borders curved, subparallel, rounded behind, furnished with spines and setæ on outer and posterior margins.

One specimen from Fajardo, 6 by 2.9 mm.

BRANCHUROPUS, new genus.

Eyes well developed, lateral; first antennæ projecting beyond head, peduncle 3-jointed, first and second joints forming an angle with one another; peduncle of second antennæ 4-jointed; palp of maxillipeds small, 1-jointed, sparsely setose; epistome slender, spatulate, emarginate in front. Thoracic limbs resembling those of *Eurydice*. Pleopods confined to middle half of pleon, on each of the first four segments flanked externally by a longitudinal triangular plate, largest on the fourth, external to this the pleon concave.

Uropods resembling the pleopods, hidden beneath the telson; peduncle long, slender.

This genus shows affinities with *Eurydice* in the character of both pairs of antennæ, the mandibles, the thoracic limbs, and the general shape of the body. It is related to *Anuropus* in the 1-jointed palp of the maxillipeds and the pleopodal character of the uropods. It differs from the latter in the possession of eyes, the more normal character of the first antennæ, in the character of the thoracic limbs, and the general habit of the body. It seems to connect *Anuropus* with the more normal members of the *Cirolanidæ*, and makes it more difficult to remove the former to a new family, *Anuropidæ*, as has been proposed. *Anuropus branchiatus* Beddard is a deep-sea form, obtained by the *Challenger* in 1,070 fathoms between New Guinea and the Admiralty Islands. It is interesting to find in the West Indies a shoal-water species agreeing with it in such remarkable particulars as have been set forth.

Branchuropus littoralis, new species.

Body moderately convex, about 2.75 times as long as broad; abdomen not abruptly narrower than the thorax. Head rounded in front, about half as wide as greatest width of body, about two-thirds as long as wide.

Thorax broadest at fifth joint, fifth and sixth joints longest; the rest shorter and subequal. Epimera of all but first joint distinct; sides of first segment emarginate, the anterior portion being produced somewhat to embrace the eye; epimera of second and third joints not produced posteriorly, of fourth, fifth, sixth, and seventh produced in a sharp process terminated by a spine, that of the last extending beyond the first abdominal segment.

Abdominal segments all distinct, gradually increasing in length from first to fifth; first joint somewhat narrower, not produced posteriorly at sides, exposed throughout its breadth; the other free segments subequal in breadth, strongly produced posteriorly at sides, the last two armed at each angle with a stout spine.

Telson rounded, about five-sixths as long as broad, margin not armed, abruptly higher in median two-thirds at base, with an ill-defined, low protuberance or process on each side of middle line.

Eyes large, black, space between about as great as diameter of eye. Base of first antennæ projecting from beneath overhanging front; peduncle of three joints, the first and second forming a right angle, the second and third joints subequal; flagellum 4-jointed, first joint long and tapering, 1.5 times as long as the other three, second and third joints subequal, last joint short and reaching to beyond posterior margin of head.

Second antennæ long and slender, when placed close to sides of body reaching to about anterior margin of telson; peduncle 4-jointed, joints increasing gradually in length and slenderness, second joint furnished on distal external angle with 4 or 5 setæ; flagellum with about 18 joints which are longest in its middle.

Epistome slender, expanded in front and emarginate, reaching to about the level of frontal margin of head but not connected with it.

Mandible with tridentate cutting edge, movable pectinate appendage and 3-jointed palp, in general resembling this organ in *Eurydice*.

Maxillipeds 2-jointed, the basal joint long, somewhat transversely of the head; the second joint short and armed with a few hairs distally.

Thoracic limbs gradually increasing in length posteriorly. First limb with second joint longest, the third, fourth, and fifth successively shorter, the sixth joint as long as third, and pectinate by a series of spines, the last one stoutest, and the seventh not forming with the sixth a subchelate hand, as in *Anuropus*. The posterior border of the limb is furnished with spines and setæ. Second and third pairs subsimilar with the fifth joint larger. Fourth to seventh pairs backwardly directed, and becoming successively broader and flatter, resembling the posterior limbs of *Eurydice*, the fourth pair with numerous stout spines along its internal edge, these becoming fewer and weaker on posterior pairs, which are more abundantly furnished with long slender setæ, fifth joint of last pair of legs broad and almost rectangular.

Abdominal appendages subsimilar, the uropods not projecting beyond the margin of telson, attached to under side, in structure similar to the pleopods and probably branchial in function.

Color gray, with arborescent brown pigmentation becoming more dense posteriorly, on abdomen collected principally in a median wedge-shaped mass with the apex on base of telson, each segment of pleon with two subelliptical paler lateral areas, with about 25 to 30 longitudinal lines of pigmentation, the areas between which are reticulated with brown. Mandibles, legs, and under side of body more or less pigmented.

One specimen, from station 6079, 20 fathoms, 6 by 2.2 mm.

CORALLANIDÆ.

Corallana tricornis Hansen.

Body 2.75 to 3 times as long as broad. The head in the male is concave above, in the median line produced into a process projecting upward and forward, and with a smaller but prominent process at the upper inner margin of each eye. In the female the head is slightly concave above, rounded in front, and without either frontal or supraocular processes, about 2.5 times as broad as long.

In the male the first thoracic segment is very convex and furnished with two tubercles near its anterior edge, which are absent in the female. The fifth thoracic segment is longest and broadest, the first, fourth, and sixth almost as long, the rest shorter.

The abdomen is about as long as the width of the body, in some specimens the first segment being exposed, on others it is more or less completely covered by the last thoracic segment. The first four segments are subequal, the fifth a little longer and narrower, all with small tubercles on posterior margin; third, fourth, and fifth segments with a median dorsal depression. Telson triangular, abruptly narrower behind attachment of uropods, the middle of the lateral margin incised. Tip of telson with four spines; margin from front of lateral incision with long setæ, a row of short setæ near front edge of incision, and a longitudinal column on each side of middle line. Telson somewhat concave in middle line and also depressed on each side between the lateral incision and the base; not ornamented with tubercles.

First antennæ about as long as peduncle of second antennæ, peduncle 2-jointed, flagellum 9 to 10 jointed. Flagellum of second antennæ about 1.5 times as long as peduncle, about 20 joints. Uropods extending beyond end of telson, outer branch narrow, bifid at tip, inner ramus broad, nearly two-thirds as broad as long, with 9 or 10 spines; margins of both branches with long setæ.

Twelve specimens from a ray taken at Hucares, 8.2 by 2.8 mm.

ALCIRONIDÆ.

Key to Porto Rican genera and species.

a. First maxillæ greatly enlarged, very conspicuous, not concealed by other mouth parts, stout, with one strong, curved apical spine, and an internal knob-like process on the outer joint; the inner joint capped by an expanded papillose disc .... *Nalicora*, new genus.
Only species .... *N. rapax*, new species.
aa. First maxillæ not conspicuous, more or less concealed by other mouth parts, with two smaller curved spines on outer joint; inner joint not expanded at apex .... *Alcirona*.
Only Porto Rican species .... *A. hirsuta*, new species.

NALICORA, new genus.

Clypeus small, peduncle of second antennæ long; mandible weak, with bidentate cutting edge and 3-jointed palp; first maxillæ very large, robust, and conspicuous in situ, outer joint stout, hooked, and terminated by a strong, curved spine in the male, continuous in contour with the rest of the part and with a knob-like process at its base; inner joint with its tip covered by a quadrate, curve-faced cap covered with papillæ; second maxillæ 4-jointed, first two joints stout, short, third joint stout and subconical, terminal joint slender and conical, with a tuft of setæ near tip; palp of maxillipeds 5-jointed, slender.

This genus somewhat resembles *Lanocira*, but the characters of the maxillæ serve to differentiate it.

Nalicora rapax, new species.

Body convex, about 2.3 times as long as broad, first thoracic segment longest, next five about two-thirds as long and subequal, last shorter; posterior four thoracic segments with a row of setæ across middle and another on posterior margin, hairiness increasing posteriorly, occasionally a few setæ on second and third. Fifth segment broadest.

Pleon and telson about two-fifths as long as rest of body. Pleon of four visible segments, first short and narrower than second and third and hidden at side by seventh thoracic; second somewhat produced at posterior lateral angle; third segment strongly produced, angle reaching to beyond base of uropods.

Epimera of all the thoracic segments except the first distinct, of second and third not produced posteriorly, the following ones successively more produced, the last two terminating in strong angles.

First antennæ about as long as peduncle of second antennæ; peduncle of two equal joints, flagellum slightly longer than peduncle, about 8 or 9 jointed; distal ends of segments furnished with a few short hairs; second antennæ reaching to end of second thoracic segment; peduncle 5-jointed, fifth joint longest, slightly exceeding the fourth, which is as long as first three joints together.

Mandible weak, with bifid cutting edge and 3-jointed palp. First maxilla large, robust; plate of first joint expanded at distal end into a somewhat quadrate curved face closely beset with papillæ and looking like a triturating plate; third joint very stout, strongly curved with a very strong terminal spine continuous in contour with the rest of the joint; at base of curved portion, on inner side, a stout knob-like protuberance. The first maxilla is the largest and most conspicuous of the mouth parts, overlapping and hiding the mandible, and in the male reaching to the base of the antennæ. In the female the terminal spine is straighter, not so continuous with the rest of the plate, and points inward and somewhat backward. Second maxilla 4-jointed; first two joints short and stout; second joint stout, decreasing distally; third joint slender and tapering, set at an angle to second joint and furnished at its tip with several setæ, one of which is usually longer and stouter than the others.

Maxillipeds with rather slender 5-jointed palp, more slender in male, first joint shortest, second joint longest, 2 to 3 times as long as first.

First pair of thoracic limbs with fifth joint set obliquely to the plane of the preceding joints, very short, almost hidden on inner or anterior face, but triangular and appearing to be deeply embedded in fourth joint when viewed externally; fourth joint with about 4 stout spines on inferior edge, second limb with fifth joint longer and with slight obliquity; third pair similar but longer. Pairs 4 to 7 more slender, with numerous spines, the third, fourth, fifth, and sixth joints subequal.

Uropods stout, the peduncle prolonged at its inner angle into a robust process. Inner ramus broad (about 1.5 times as long as broad), extending beyond end of telson; outer ramus shorter and narrower, extending barely beyond tip of telson; apex truncate or subbifid.

Telson triangular, about two-thirds as long as broad, lateral margins somewhat excavated, apex narrow, rounded.

Seventeen specimens from stations 6062 and 6063, 25 to 75 fathoms. Largest 8.5 by 3.8 mm.; smallest 5.5 by 2.5 mm.

Alcirona hirsuta, new species.

Front slightly produced and somewhat inflexed between the bases of the antennules, not joining the epistome; eyes small, lateral, distance between two or three times their diameter.

Body strongly arched antero-posteriorly. Epistome narrow, pentagonal. First antennæ with 2-jointed peduncle reaching to about end of fourth joint of antennal peduncle. Flagellum slightly shorter than peduncle, of 7 joints, first joint as long as second and third.

Second antennæ reaching to middle of third segment, with 5-jointed peduncle; first three joints short, fourth and fifth joints each about twice as long as third and subequal, flagellum with 17 joints. Mandibular palp rather robust, 3-jointed, second joint longest, second and third joints with setæ.

Maxillipeds with 5-jointed rather robust palps.

First segment of trunk about 1.6 times as long as second, the next five equal, the seventh a little shorter; third segment with a few setæ on lateral portion of posterior margin; fourth, fifth, sixth, and seventh with complete rows becoming successively more dense posteriorly. In one specimen a very few hairs at side of second segment. First three pairs of pereopods subsimilar, fourth joint broad and armed with several very strong spines, fifth joint very short, almost hidden in the first leg, somewhat longer in the second and still longer in the third. Seventh joint pectinate, with four long spines in the first leg, in the second and third legs these becoming weaker. Claws strong in all.

Last four legs successively longer and relatively to their length more slender than the first three pairs, heavily armed with numerous brown-tipped spines.

Pleon of five visible segments, dorsally strongly setose, first and second segments narrow and laterally covered by the seventh thoracic segment, the first being visible only dorsally; third segment posteriorly produced at the sides, covering the lateral portion of the fourth segment, which is the longest in the median line. This region is so setose that it is difficult to delimitate the segments.

Telson triangular, with the tip rounded and armed with 6 spines, about two-thirds as long as broad; dorsal surface and posterior margin with numerous setæ. Uropods extending somewhat beyond end of telson, inner branch the longer, not much longer than broad, rounded, with about 10 marginal spines and numerous setæ, about half as long as the ramus itself: external ramus narrow, with about eight spines and numerous setæ on the posterior and outer margin.

This species is close to *A. insularis*, from which it differs in its greater hairiness.

Two specimens. Station 6079, 20 fathoms, 5 by 2.3 mm.

ÆGIDÆ.

Key to Porto Rican genera and species.

a. Peduncle of first antennæ dilated anteriorly and not hidden by front margin of head; flagellum consisting of more than 6 joints; head not much produced in front of eyes; epistome large; maxillipeds consisting of 6 or 7 joints .... *Æga*

Only Porto Rican species .... *A. ecarinata*

aa. Peduncle of first antennæ not dilated, more or less hidden by the projecting front of head, flagellum of 6 joints or fewer; head projecting well in front of eyes, front triangular; epistome minute or rudimentary; maxillipeds consisting of 4 joints .... *Rocinela*

Only Porto Rican species .... *R. signata*

Æga ecarinata Richardson.

"Body elongate and narrow. Length more than three times greater than breadth. Surface punctate. Frontal margin of head bisinuated, the acumen separating the first pair of antennæ. Eyes large and oblong and situated at a small distance apart. First pair of antennæ extending almost to flagellum of the second pair of antennæ; the first two joints of peduncle very broad; second joint extending anteriorly over the third joint, reaching almost to the extremity of that joint; third joint two-thirds narrower than first and second; the flagellum containing nine articles. Second pair of antennæ extending to middle of the first thoracic segment; flagellum containing ten articles."

"Epimera of all the thoracic segments narrow, the first two being rounded, the other four more acute at their extremities. First two pairs of prehensile legs rather stout; third pair less so, and the propodus of this pair is furnished with a large cultriform process. Five spines are present on the merus of all three pairs. Gressorial legs slender and sparsely spinulose."

"All the abdominal segments are visible in a dorsal view. Terminal segment broad and posteriorly bisinuated, forming three teeth with rounded extremities; its surface entirely smooth."

"Outer branch of uropods narrower and somewhat shorter than the inner branch; its extremity is rounded. Inner branch obliquely truncate and crenulate on posterior margin. Uropods and terminal abdominal segment all fringed with a few hairs."

One specimen, station 5052, 310 fathoms, 37 by 11 mm. This specimen was found on deck after the dredge was landed, and probably did not come from the bottom.

Rocinela signata Schiödte & Meinert.

Female, body oval, about 2.25 to 2.50 times as long as broad. The front is triangular and obtusely produced. The fifth and sixth thoracic segments are longest, the fourth and seventh are somewhat shorter, the second and third are shortest, and the first is less than the seventh and a little shorter than the head. The first pleonic segment is narrower than its successors, and more or less hidden dorsally, its posterior margin bisinuate; the next three segments are wider and subequal in length; the fifth segment is narrow, partly hidden laterally by its predecessor, and longer dorsally.

Telson subtriangular, about two-thirds as long as broad, its dorsal surface usually ornamented with three bands of pigmentation, the median one straight, longitudinal, the lateral ones transversely arched; a row of pigment spots on each side near the tip, parallel with the margin; posterior border crenulate and furnished with setæ. Eyes small, separated by about one-third of breadth of head. First antennæ reaching to about middle of last joint of peduncle of second antennæ, flagellum 4-jointed. Second antennæ reaching to middle of second thoracic segment, peduncle extending to posterior border of eye, flagellum 11 to 12 jointed. Epistome minute or absent.

Epimera rather large, slender, posteriorly produced and acutely angled, the last reaching nearly or quite to the middle of second abdominal segment.

Uropods hardly reaching to end of telson, inner ramus narrow, not much wider than the outer and a little longer; both branches rounded posteriorly, their borders crenulate and furnished with setæ, with spines on their external borders.

Specimens from Culebra, 12.5 by 5 mm.

CYMOTHOIDÆ.

Anilocra laticauda Milne-Edwards.

Ovigerous female. Body elliptical, about 2.6 times as long as broad.

Head of moderate size, subtriangular, about as long as first segment of trunk, about two-thirds as long as broad, front of head produced.

Eyes oval, half as long as lateral walls of head, about two-thirds as wide, distant from one another somewhat more than their length.

First antennæ 8-jointed, reaching to about posterior border of eye; peduncle dilated, second joint with anterior distal angle expanded; flagellum at an angle with peduncle, flattened. Second antennæ dilated, consisting of 9 to 10 joints, reaching to about middle of first trunk segment.

Thoracic segments gradually increasing in length from second to sixth, seventh about equal to third, first and fourth about equal. Anterior margins of first distinctly retreating behind eyes, first, second, third, fourth, and fifth rounded at posterior lateral angles, sixth somewhat produced, seventh strongly produced and reaching to angle of first abdominal segment. Epimera of second and third broadly rounded posteriorly, reaching to about posterior margin of segments; of fourth more slender, reaching to beyond middle of its segment; of fifth, sixth, and seventh more slender, sinuous, and reaching to about middle of their respective segments.

The legs are in two series, the first three are directed forward and inward, and the last four backward. They increase in length from before backward. The first pair have the second joint short and stout, the fourth and fifth subequal, the sixth longer and about equal to the third, the terminal joint with a stout curved claw, reaching to fourth joint when inflexed. The second joint with a keel on anterior outer edge. The next five pairs are subsimilar. The seventh pair much longer than the others, all of the joints except the seventh being lengthened, claw when reflexed reaching only to fifth joint; the first joint with the outer face with a shallow groove. None of the legs with spines or setæ. Six segments of pleon distinct, about one-third the length of body, first five segments shorter than the telson, about two-thirds as long as broad; first segment partly hidden dorsally by last thoracic segment, the rest of the segments subequal, laterally produced, the posterior lateral angles all exposed, of first and second rounded, of third and fourth notched, of fifth strongly notched and fitting around the sides of base of telson.

Telson subcircular, about as broad as long, with a depression on each side near base.

Uropods reaching to about end of telson, internal branch broader and a little longer than external, rounded posteriorly; external ramus falcate.

Color plumbeous.

From Arroyo and Vieques. Two specimens, 35.5 by 14 mm. and 13 by 5 mm.

SPHÆROMIDÆ.

No attempt is made to furnish a key to the genera owing to the extreme confusion that exists in this family, and it is doubtful if the following two species are properly assigned generically. The dissimilarity of the sexes has frequently misled authors into placing them in widely separated genera, and, while this has not been done in the present case, the limitations of the genera are so indefinitely established that the author has not been able to satisfy himself of the generic affinities of the species described.

Cilicea caudata Ives.

Body of male twice as long as broad. Head about 2.5 times as broad as long, produced in a rounded process between the bases of the first antennæ, above each of which there is a rounded notch; rest of frontal margin thickened. Eyes convex, in posterior lateral lobes. First segment about two-thirds as long as the head, laterally notched to receive the lobes of head and produced beneath the eyes, next four about two-thirds as long, the sixth and seventh about equal to first. Lateral margin of first segment long, slightly produced backward and sharply angled at each end; posterior margins of following segments somewhat deflected backward at sides. The sides of segments two to six are narrower externally than the dorsal portions, owing to the thinning of the anterior border to form a ridge over which the grooved posterior surface of the preceding epimeron rides. The last thoracic segment does not extend so far ventrally as the preceding ones.

The free abdominal segment is broader and wider than the last thoracic segment, with two or three furrows at the sides; on its posterior border are three low processes, from a crater in the top of each of which a tuft of setæ projects. The telson has three prominent processes projecting backward from its base, the central one with a tuft of setæ. At the base of the apical incision there is a broad rounded process. The apical notch is furnished with four teeth, two small ones at the base and two larger ones outside of them and at a slightly lower level. The two limbs forming the borders of the notch are notched at their tips and furnished with a tuft of setæ.

The uropods have a long, curved outer branch. The posterior part of telson and the uropods are covered with very short, close-set soft hairs and scattered tufts of longer ones. Most of the body is minutely tuberculate, with scattered tufts of two or three setæ. The epistome is broad, pointed in in front and widely forked behind, the two limbs embracing the clypeus.

First antennæ have a 3-jointed peduncle, first joint long, stout; second joint deeply embedded in first; third joint as long as second, slender; flagellum 11-jointed, setose, about as long as peduncle; second antennæ extending to about end of third segment; peduncle 5-jointed, slender; flagellum 14-jointed, a little longer than peduncle. Mandible with cutting edge, molar surface and palp. Maxillipeds with 5-jointed palp, of which the last is slender and the second, third, and fourth strongly produced internally; plate of second joint broad, with hooks and terminal spines. Thoracic legs increasing in length posteriorly, more or less setose, terminal joint biangulate.

Female smaller, resembling male in head and thorax. First joint of abdomen without tubercles; basal processes of telson small, no process at base of apical incision; apical incision small, simple, rounded, without teeth; outer ramus of uropods lamellar, inner ramus well developed, lamellar, fused to peduncle.

From coral reefs at Mayaguez, Boqueron Bay, Puerto Real, Arroyo, and Fajardo. Largest male 7.5 by 3.5 mm. Largest female 4.8 by 2.3 mm. Color in life, red or pink.

The smaller form was described as *Cymodocea burmudensis* by Ives, who at first suspected that it was the female of the other, but concluded otherwise upon finding male organs upon one specimen. In Porto Rico the two were always found associated and as all the larger forms were found to be males, while none of the smaller ones could be so determined, I am inclined to believe that Mr. Ives's specimen was an anomaly. The two forms agree in all particulars save only those which are generally recognized to be sexual.

The form described by Miss Richardson as *Dynamene nodulosa* is probably the female of *Cilicea caudata gilliana* Richardson, or of a related species.

Dynamene perforata, new species.

Body stout, about twice as long as broad, slightly increasing in breadth posteriorly, sides almost straight. Head short, broad, a little over half as wide as greatest width of body (about 3.5 times as broad as long). First thoracic segment longest, about equal in length to head; last thoracic segment shortest, about half length of first; other five segments equal, about two-thirds as long as first; first segment strongly excavated near sides to receive the eye lobes of posterior margin of head, anteriorly produced at lateral border to an acute process beneath the eye.

The lateral margins of all of the thoracic segments are somewhat produced posteriorly, the posterior edge being grooved to slide over a ridge on the outer anterior margin of the succeeding epimeron when the animal rolls into a ball, the segments thus locking against a transverse stress; the epimeron of the last segment, which in the male is longer than the others, is without this groove, but it slides outside of a forwardly projecting process or lug. The lateral margin of the first segment is long and straight, of the second, third, and fourth is narrower than the dorsal length, the fifth, sixth, and seventh broader and more rounded, the latter being more distinctly produced behind the posterior dorsal margin of the segment, especially in the male, where it forms a large epimeral plate.

Free joint of abdomen a little less than one-third length of telson, produced into a posteriorly projecting process over lateral margin of telson, at base of process a lobe crossed by a suture, indicating probably two of the fused segments which constitute the free abdominal segment.

Telson in male triangular, notched posteriorly; in front of notch a groove in median line connecting with a transverse foramen. This region varies in different individuals; in some the groove is shallow, and in some it is deep, and in one it is clearly an incision connecting the terminal notch with the foramen. The latter is apparently formed by the coalescence of the lips of a deep terminal notch. The posterior bilobed margin of the foramen is more elevated than the anterior. In the female the telson is more rounded, there is no foramen, and the terminal notch in most cases is obscure, although one specimen presents an appearance like other species of the genus. In some there is an appearance of thinness of the telson in the region occupied by the foramen of the male. In both sexes the telson is globose above, and at its base projects outside the base of the uropods in an epimeral-like process.

In the male the abdomen and the posterior margin of the last three thoracic segments are ornamented with small, close-set papillæ, lacking in the female. In both sexes there are very short hairs scattered over the body.

The eyes are prominent and strongly convex; first antennæ extending beyond first joint of thorax, peduncle 3-jointed, first joint stout, somewhat constricted in the middle, second joint short, third about twice as long as second, flagellum 7-jointed, joints gradually decreasing in length, furnished with sensory hairs; second antennæ reaching beyond second joint of thorax, peduncle 5-jointed, first three joints short, fourth longer, fifth longest; flagellum a little longer than peduncle, 11-jointed; mandible stout, with 2 dental plates on right side, 1 on the left, a strong molar plate, and a 3-jointed setiferous palp, the joints of which decrease in length distally; first maxilla with 4 plumulose setæ on tip of first joint and a group of stout spines at apex of third joint; second maxilla with 3 plates, each armed with about 3 stout curved spines; maxillipeds with a 5-jointed setiferous palp, the terminal two joints slender, the second and third produced to a rounded lobe at internal distal angles, plate of second joint of maxilliped long and broad, and furnished with about 6 stout pectinate setæ distally and a hook which locks it with its fellow of the other side.

Thoracic limbs increasing from first to last, all furnished with hairs and spines; fifth joint of first pair short and triangular, much longer in second and third pairs, in fourth pair shorter than in the two preceding pairs, gradually increasing to the seventh pair, where it is about as long as in the third, but much stouter. The seventh joint of all the legs is furnished with a stout terminal claw with a smaller one at its base. Uropods broad and leaf-like, rounded posteriorly, and serrate or crenulate, outer ramus shorter than inner and folding beneath it, both extending beyond tip of telson.

About 50 specimens from mangrove roots at Culebra, 3.4 by 1.7 mm.

Tribe VALVIFERA.

IDOTEIDÆ.

Cleantis planicauda Benedict.

Body linear, densely granulated, five times longer than broad. Feet folded beneath out of view from above. Body lined longitudinally by six more or less broken black lines. The lines on the side are more distinct than those above.

Head subquadrate, partially immersed in the first thoracic segment and rounded on the posterior margin; sides parallel, anterior margin emarginate; a deep depression or groove runs from the median notch to the center of the head. The eyes are situated near the antero-lateral angle; postoccipital lobe distinct; antennæ with six segments; first very short and nearly immobile; second very short and stout; the third segment is equal in length to the second, but not so stout; the fourth and fifth are of equal length and about one-third longer than the second and third segments. The terminal segment or flagellum is lighter in color and is armed with short bristles. The length of the antennæ is equal to the length of the head and first two thoracic segments. The antennulæ extend to the middle of the third segment of the antennæ. The first segment is quadrate; the second subquadrate; the third is pear-shaped; the fourth segment is very small.

The segments of the thorax are nearly equal in length and breadth, the third and fourth being but little longer than the others. The epimera of the second, third, and fourth segments are very small and can not be seen from above. On the fifth, sixth, and seventh segments the epimera are large and project well behind the margin of the segment in the form of an acute angle.

The pleon is composed of four segments; the first three are very narrow; the terminal segment is elongated with subparallel lines. A marked character of the pleon is its obliquely truncated extremity. The oblique terminus is perfectly flat with a raised margin.

The feet of this species, as in the typical species described by Dana, are in two series. The first is composed of the first three pairs of feet, which are comparatively stout and increase in length to the third segment. The second series begins on the fourth segment with a pair of short feet which fold transversely; the other pairs are successively longer and fold backward. The feet of the second series are much more slender than those of the first. The dactyli of all are biungulate. The carpal and propodal joints are spinulose beneath.

The operculum is not traversed by an oblique line. The sides of the basal segment are subparallel. The terminal segment is about as broad as long.

The above is the original description, to which I wish to add that the fourth pair of legs consists of but six segments, the ungual joint being absent.

From Mayaguez and Vieques. Largest specimen, 14 by 2.5 mm.; smallest, 6.5 by 1.6 mm.

Tribe ONISCOIDEA.

LIGIIDÆ.

Ligia gracilis, new species.

Body elongate-ovate, rather narrow; about 2.75 times as long as broad.

Head about 2.5 times as broad as long, breadth about two-thirds of greatest width of body, rounded in front, bilobate posteriorly. First segment of thorax longest, the next five subequal, the last somewhat shorter; first segment with front margin excavated to receive lobes of head, which, on account of their convexity, appear to overlap it, produced beneath the eyes at anterior lateral angles; second, third, fourth, and fifth segments of about equal breadth; posterior margins of first, second, and third segments nearly straight; fourth segment somewhat produced at posterior lateral angle, the last three segments strongly produced to acute angles; seventh segment with posterior margin excavated dorsally so as to uncover the first segment of pleon.

Abdomen constituting about one-third of total length of body; first two segments short and narrow, the postero-lateral angles not produced; first segment (sometimes the second) hidden laterally by the angle of the last thoracic segment; third segment widest, the next two successively narrower and longer, all three strongly produced at postero-lateral angles; telson about three-fourths as long as broad, with a sharp tooth at postero-lateral angle and 2 blunt, rounded teeth inside of it on each side; in the median line there is a blunt angle, but no sharp tooth, as in *L. olfersii* and *L. exotica*.

The lateral borders of all of the thoracic and abdominal segments are fringed with minute teeth.

Eyes large, black, lateral, strongly convex, facets small, numerous; first antennæ minute, 3-jointed; second antennæ, when folded back along sides of body, reaching to about end of thorax; peduncle 5-jointed, first two joints short, subequal, last three successively longer, flagellum about 1.5 times as long as peduncle, consisting of about 37 joints.

Mandible without palp, with two apical plates armed with three teeth each, and a dentate plate on internal face. Molar surface beset with small setæ around its base, a row of large plumulose setæ around base of inner dental lamella.

First maxillæ with plate of first joint furnished with three stout plumulose spines and a tuft of slender hairs, third joint with stout spines; second maxilla with one large plate and a shorter, more slender one; maxillipeds broad, with a 5-jointed palp, bearing setæ on its inner edge and stout spines on outer edge and ventral face; plate of second joint furnished with many short crowded spines and setæ.

The thoracic legs increase in length from first to last; in all, the terminal joint is short and biungulate, the sixth or penultimate joint is long, and in the last pair of legs the sixth and seventh joints together equal or slightly exceed the fourth and fifth combined; all of the legs are more or less spiny in all of their joints.

The uropods are biramous, the inner ramus being about twice as long as the peduncle; outer ramus broken.

Ten specimens from Culebra, under algæ and drift alongshore. Largest specimen, 15 by 5.5 mm.; smallest, 5 by 1.5 mm.

ONISCIDÆ.

Philoscia culebræ, new species.

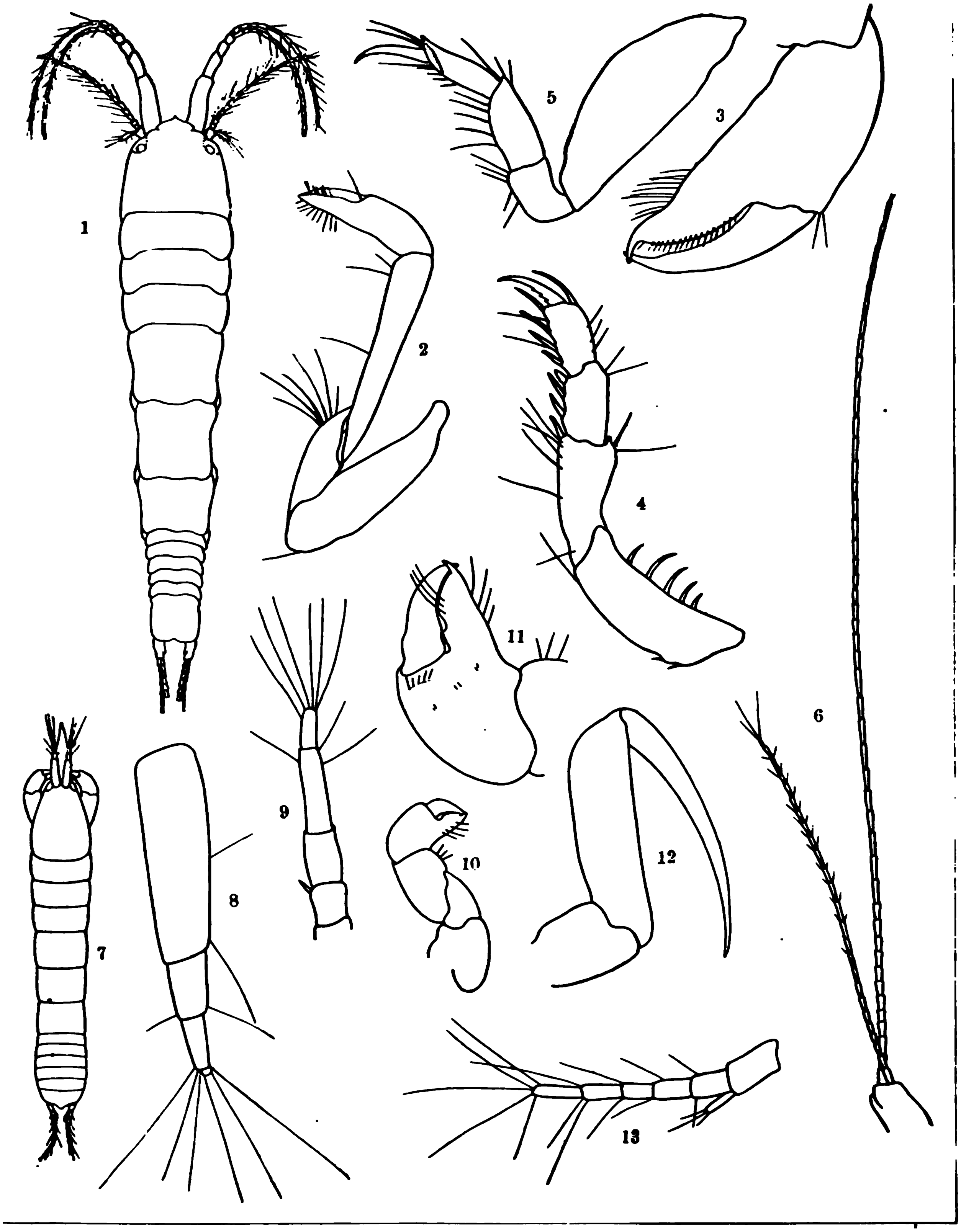
Body elongate-oval, about 2.5 times as long as broad; head about twice as broad as long, front somewhat recurved between sides and middle, producing the appearance of a small lobe in front of each eye, sides and posterior margin rounded; first segment of thorax longest, its anterior and posterior margins strongly curved, anterior angle rounded and projecting somewhat beyond sides of head; next six segments subequal in length, second, third, and fourth widest, the last three successively narrower; posterior angles of last four segments produced, successively increasing in length, that of last reaching almost to posterior border of third abdominal segment; abdomen almost as long as last three segments of thorax, gradually decreasing in width posteriorly; segments subequal in length, the sides of the first more or less concealed by the lateral angle of the last thoracic segment; telson, short, hardly longer than other segments, produced to a blunt point in median line posteriorly.

Eyes moderate (for the genus); first antennæ minute, second antennæ when laid against sides of body extending to about end of second thoracic segment, spinose; peduncle, 5-jointed; first joint, short; second and third, equal; fourth, longer; fifth, longest, equal to third and fourth combined; flagellum 3-jointed, about equal to last joint of peduncle. Mandible with narrow 4 or 5 dentate tip, at the base of which are two plumulose setæ, and lower down a brush of fine setæ; no palp. First maxillæ with inner plate furnished with several small spines; outer plate with many.

The legs increase slightly in length from before backward and are furnished with long, acute spines. The uropods are broken off.

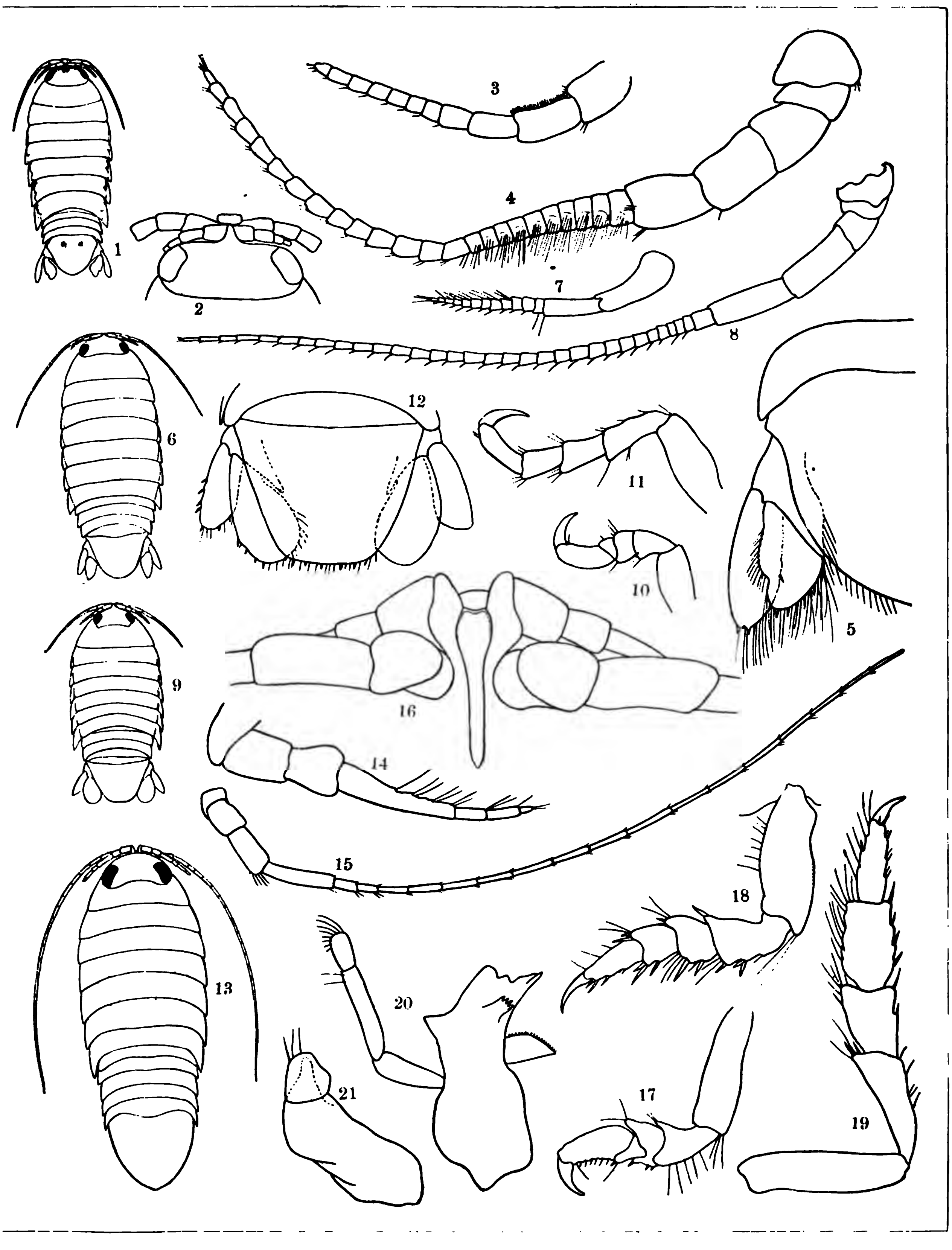
From Culebra. Two specimens, under drift on shore, 4.2 by 1.6 mm.

PLATE 7.



Figs. 1-6. *Apseudes espinosus*, n. sp.—Fig. 1, animal, × 15. Fig. 2, first leg, × 33. Fig. 3, chela, × 100. Fig. 4, second leg, × 33. Fig. 5, seventh leg, × 33. Fig. 6, uropoda, × 33.

Figs. 7-13. *Leptochelia incerta*, n. sp.—Fig. 7, animal, × 14. Fig. 8, first antenna from above, × 77. Fig. 9, second antenna from below, × 77. Fig. 10, left cheliped, × 33. Fig. 11, left chela, anterior view, × 77. Fig. 12, end of second leg, × 77. Fig. 13, uropod, × 77.



Figs. 1–5. *Cirolana mayana* Ives.—Fig. 1, animal, × 3. Fig. 2, head. Fig. 3, first antenna, × 40. Fig. 4, second antenna, from below, × 40. Fig. 5, left side telson and uropods from above, × 23.

Figs. 6–8. *Cirolana parva* Hansen.—Fig. 6, animal, × 5.3. Fig. 7, first antenna, × 33. Fig. 8, second antenna, × 33.

Figs. 9–12. *Cirolana obtruncata* Richardson.—Fig. 9, animal, × 6. Fig. 10, first leg. Fig. 11, seventh leg. Fig. 12, telson and uropods from above.

Figs. 13–21. *Branchuropus littoralis*, nov. gen. et sp.—Fig. 13, animal. Fig. 14, first antenna, from above, × 83. Fig. 15, second antenna, from below, × 33. Fig. 16, front of head, from below. Fig. 17, first leg, × 33. Fig. 18, fourth leg, × 33. Fig. 19, seventh leg, × 33. Fig. 20, mandible, × 83. Fig. 21, maxilliped, × 100.

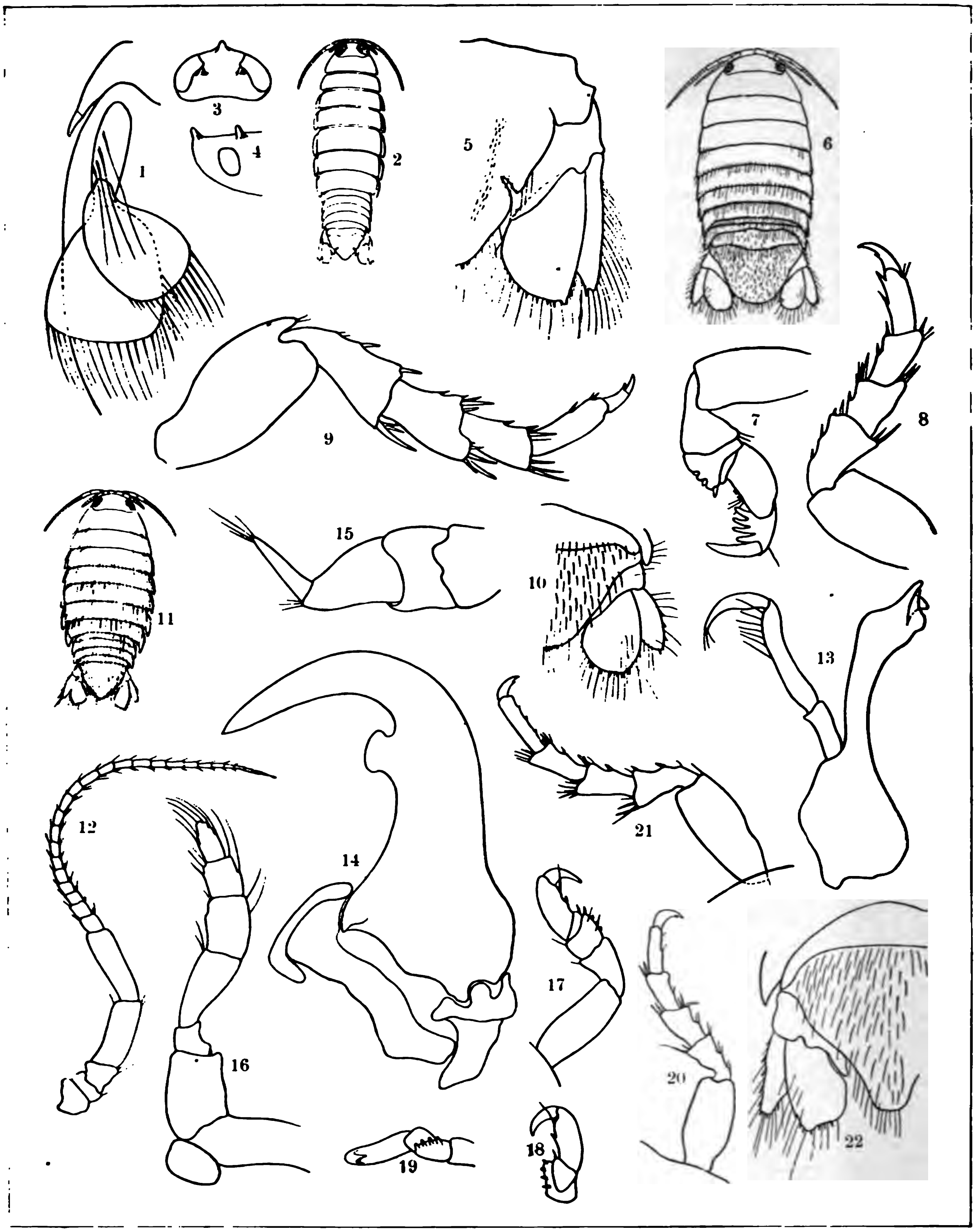


Fig. 1. *Branchuropus littoralis*, nov. gen. et sp.—Uropods, right side from below.

Figs. 2–5. *Corallana tricornis* Hansen.—Fig. 2, animal, × 5. Fig. 3, head, top. Fig. 4, head, side. Fig. 5, telson and uropods, right side, × 33.

Figs. 6–10. *Alcirona hirsuta*, n. sp.—Fig. 6, animal, × 8. Fig. 7, first leg, × 40. Fig. 8, fourth leg, × 40. Fig. 9, seventh leg, × 40. Fig. 10, telson and uropods of right side.

Figs. 11–22. *Nalicora rapax*, nov. gen. et sp.—Fig. 11, animal, × 5. Fig. 12, right second antenna, × 33. Fig. 13, mandible, × 77. Fig. 14, first maxilla, × 77. Fig. 15, second maxilla, × 77. Fig. 16, maxilliped, × 77. Fig. 17, first leg, posterior, × 20. Fig. 18, first leg, anterior, × 20. Fig. 19, first leg, inferior, × 20. Fig. 20, fourth leg, × 16. Fig. 21, seventh leg, × 16. Fig. 22, telson and uropods, left side, × 14.

PLATE 10.

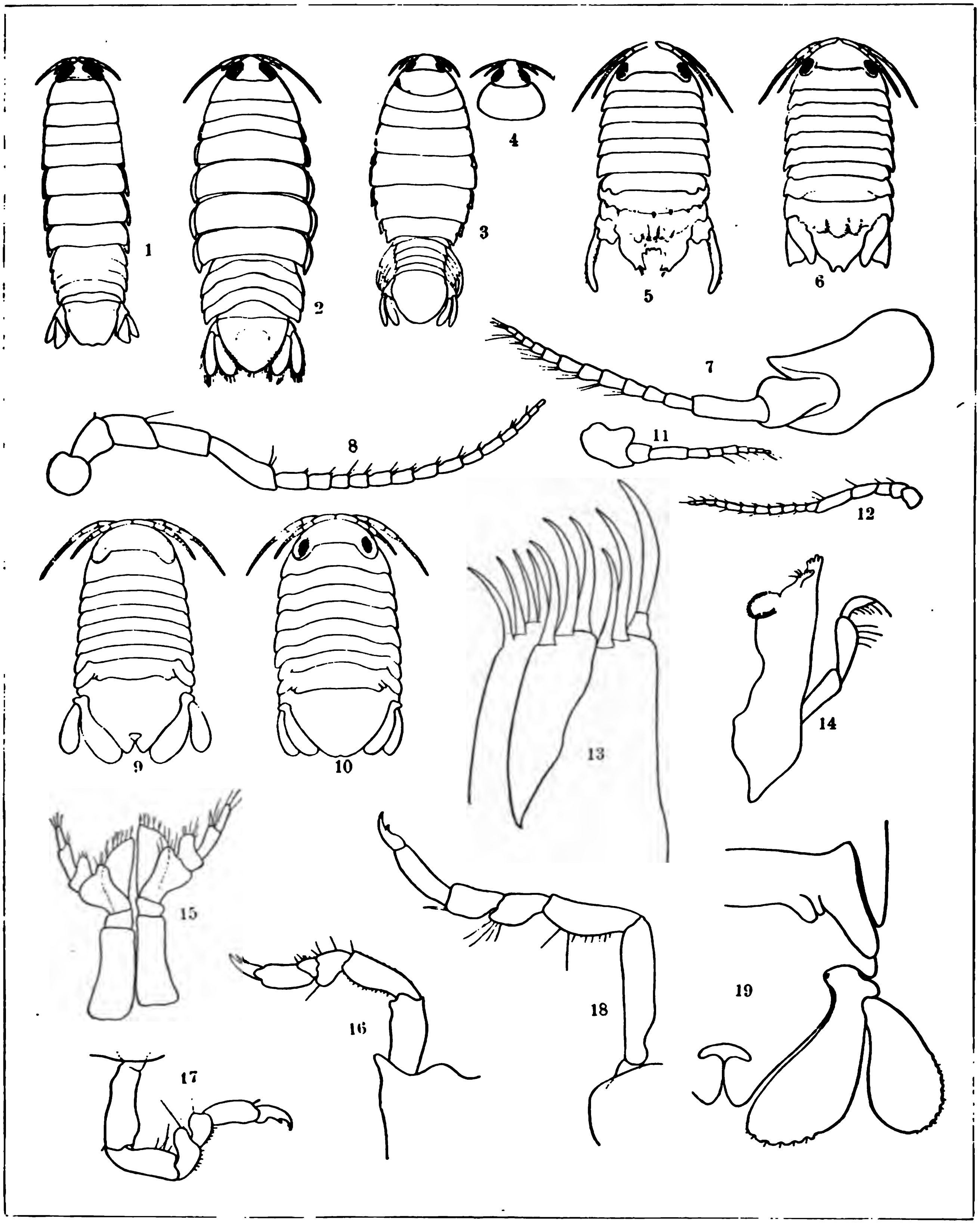
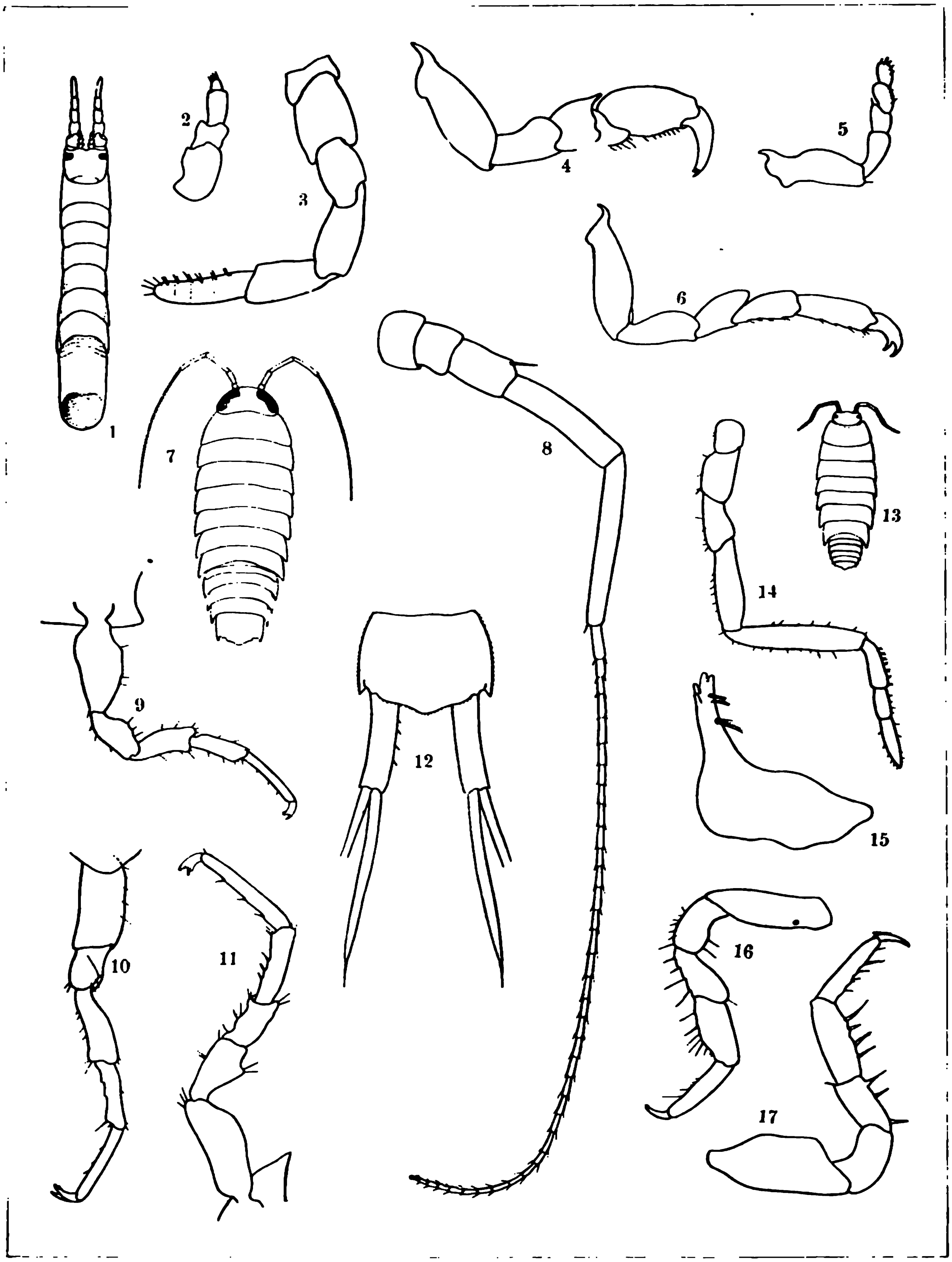


Fig. 1. *Æga ecarinata* Richardson, × 1.3.
Fig. 2. *Rocinela signata* Sch. & Mein, × 4.5.
Figs. 3, 4. *Anilocra laticauda* Milne-Edwards.—Fig. 3, animal, × 1.3. Fig. 4, head of same, × 1.3.
Figs. 5–8. *Cilicæa cordata* Ives.—Fig. 5, male, × 5.3. Fig. 6, female, × 8. Fig. 7, first antenna, × 40. Fig. 8, second antenna, × 40.
Figs. 9–19. *Dynamene perforata*, n. sp.—Fig. 9, male, × 12. Fig. 10, female, × 12. Fig. 11, first antenna. Fig. 12, second antenna. Fig. 13, tip of maxilla, highly magnified. Fig. 14, mandible, × 77. Fig. 15, maxillipeds, × 77. Fig. 16, first leg, left, × 33. Fig. 17, fourth leg, left, × 33. Fig. 18, seventh leg, left, × 33. Fig. 19, telson and uropod, right side, male, × 33.



Figs. 1–6. *Cleantis planicauda* Ben.—Fig. 1. animal. × 3.3. Fig. 2. first antenna. × 16. Fig. 3. second antenna. × 16. Fig. 4. first leg. × 16. Fig. 5. fourth leg. × 16. Fig. 6. seventh leg. × 16.

Figs. 7–12. *Ligia gracilis*, n. sp.—Fig. 7. animal. × 3. Fig. 8. second antenna. Fig. 9. first leg, left. Fig. 10. fourth leg, left. Fig. 11. seventh leg, left. Fig. 12. telson and uropods. × 11.

Figs. 13–17. *Philoscia culebræ*, n. sp.—Fig. 13. animal. × 7. Fig. 14. antenna. × 35. Fig. 15. mandible. × 77. Fig. 16. first leg. × 33. Fig. 17. fourth leg. × 33.

THE CIRRIPEDIA COLLECTED NEAR PORTO RICO BY THE FISH HAWK EXPEDITION IN 1898-99.

BY

MAURICE A. BIGELOW,
Instructor in Biology, Teachers' College, Columbia University.

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The collection of Cirripedia is small, both in number of genera and species represented and in individuals. Of ten small jars holding the collection, four contain but a single specimen each, five have from two to four specimens, and only one (*Lithotrya*) furnished abundant material for comparison and dissection, which are so important in identification of species in such a variable group. Owing to the small amount of material, some of the identifications are very uncertain as regards the species. All of the specimens are identified as belonging to well-known genera, which have been heretofore reported from the West Indies.

A glance at the list that follows shows that each of the families of *Cirripedia*, *Lepadidæ* and *Balanidæ*, is represented by two genera. In the case of the former there are two species, while the latter family is represented by possibly four species.

No Cirripedia which live at the surface of the water were in the collection. Since no new species are recorded, it seems quite unnecessary to insert in the report diagnostic descriptions of the few forms listed, but references have been given to the important literature used in identification of the specimens.

Family LEPADIDÆ.

Scalpellum (species ?).

A single specimen, apparently young, was taken at stations 6062-6063 in Mayaguez Harbor, at a depth between 25 and 75 fathoms. The specimen closely corresponds with Hoek's description (Challenger Reports) and figure of *Scalpellum pedunculatum*, but differs from his description principally in that the capitulum and peduncle in this specimen is not "clothed with numerous spines," as Hoek characterized the covering membrane in this species. The velvet-like membrane seen on the specimen under discussion is more in accord with Hoek's description of *S. velutinum*. In most other characters it is not easy to distinguish the two species as described by Hoek, and since each was based upon a single specimen collected by the *Challenger* there is possibility that variation may be so great as to invalidate the distinction between the species. It seems wisest not to attempt a definite assignment of the specimen to a species until others are obtained.

(Darwin, Monograph of the Cirripedia; Challenger Report on Cirripedia, by Hoek.)

Lithotrya dorsalis Sowerby.

Numerous specimens were taken at Ensenada Honda, Culebra, and a few off Aguadilla. The animal bores in coral and limestone rock, pieces of which were attached to some of the specimens.

(Darwin, Monograph of Cirripedia.)

Family BALANIDÆ.

Balanus (species ?).

Several specimens belonging to this genus were found in the collection. A single specimen encrusted by a millepore coral from Mayaguez, an imperfect specimen of another (?) species collected off Puerto Real, and three or four apparently young specimens of probably a third species from Boca Prieta—these comprise the representatives of the genus *Balanus*. Considering the limited number of the specimens, their undeveloped and imperfect condition, and the well-known difficulties of making accurate identifications of species in this variable genus, it is thought best not to record any guesses at identification of the species of *Balanus*.

(Darwin, Monograph of the Cirripedia.)

Tetraclita porosa Darwin.

Two specimens. Locality not recorded. Varieties of this species have been previously reported as common near the West Indies and the Caribbean Sea.

(Darwin, Monograph of the Cirripedia.)

THE POLYCHÆTOUS ANNELIDS OF PORTO RICO.

BY

AARON L. TREADWELL,
Professor of Biology, Vassar College.

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The material here described was collected by the expedition sent to Porto Rico in the winter of 1898–99, by Hon. George M. Bowers, United States Commissioner of Fish and Fisheries. The collection included 85 species of Polychætes, of which 32, so far as I could determine, are new. All observations were made on preserved material. Where no other preserving fluid is indicated in descriptions of color, etc., it will be understood that the specimen was in alcohol. If formalin was used, that fact is noted in the description.

For assistance in procuring literature I am indebted to Dr. H. M. Smith, of the United States Commission of Fish and Fisheries, Prof. H. C. Bumpus, of Brown University, and Prof. H. P. Johnson, of the University of California.

All the figures in the text were drawn by the author.

Family SYLLIDÆ.

SYLLIS Sav.

Syllis spongiphila Verrill.

Syllis spongiphila Verrill, Trans. Conn. Acad., vol. 4, pl. 24, figs. 10, 10*a*, 1881; Rept. U. S. F. C. for 1883, pl. 42, figs. 183, 183*a*; Proc. U. S. Nat. Mus. 1885, p. 435.

Professor Verrill describes the color as yellowish white. He does not say if that is the case in the living animal. Most of these agree with his description, but in some the anterior portion of the body was colored a dark brown by two rather broad brown bands in each segment. In the intersegmental constrictions is a narrower band, more sharply defined and denser in color. The eyes are farther removed from the base of the middle antenna in these than in those figured by Verrill and the terminal joint of the seta has more numerous teeth.

Collected from Boqueron Bay, station 6065, Arroyo, Puerto Real, on corals at Mayaguez.

Syllis complanata, n. sp.

Body very much flattened, with row of dark-brown spots around posterior edge of head and across posterior portion of each segment. Similar spots scattered irregularly over rest of body. Tentacles and all cirri articulated, with row of pigment granules around each annulus. Median tentacle longer than lateral, about four times as long as head. Two tentacular cirri, dorsal one rather longer than median tentacle, ventral one shorter. Palps thick at base, tapering to rounded apex. Eyes four, anterior pair the larger. Arrangement of pigment such as to give the appearance of a deep cleft on posterior margin of head. (Fig. 1.) Parapodium uniramous, with several stout aciculæ. Setæ few, compound, with long terminal articles; latter with stout subterminal tooth and row of smaller teeth behind it. No tooth in pharynx. The specimen, from Ponce, was not complete; about 150 segments present. Length, 44 mm.; width, 2 mm.

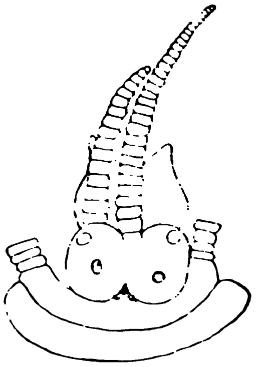


Fig. 1.—Head of *S. complanata* × 36. Right paired antenna removed to show the palp.

Family HESIONIDÆ.

HESIONE Sav.

Hesione proctochona Schm.

Hesione proctochona Schmarda, Neue Wirbellose Thiere, 1861, p. 79, pl. 28, fig. 226.
Fallacia proctochona Webster, Annelids from Bermuda, Bull. U. S. F. C. 1884, p. 311, pl. 8, fig. 21.
Hesione vittigera Ehlers, Annelids of the Blake, Mem. Mus. Comp. Zool., Cambridge, 1887, p. 143, pl. 41, figs. 1–4.
Hesione prætexta Ehlers, ibid, p. 147, pl. 41, figs. 5, 6.

According to Schmarda's original description, the anterior portion of *H. proctochona* is characterized by the absence of antennæ, the presence of eight pairs of tentacular cirri, and four eyes. There are sixteen setigerous segments, and the anus is surrounded by a funnel-like expansion, whose edges are prolonged into ten conical projections. He also describes, but does not figure, two long anal cirri. Dorsal surface brown, each segment divided into ten bands by transverse white lines. Between every two of these lines is a broader white band. A small knob on either side, in front of each parapodium.

Webster (loc. cit.) describes from Bermuda specimens which he identifies as this species. To Schmarda's description he adds the following points: There are two very minute antennæ, so small as to escape detection with a hand lens; each parapodium bears on its outer, upper angle a slender, lip-like projection, and the ante-anal segment has no setæ, but bears two very long cirri.

Ehlers (loc. cit.) compares his new species, *H. vittigera*, with *H. proctochona*. As between *H. vittigera* and *H. proctochona*, as described by Schmarda, the agreements and differences are as follows: Both have 16 tentacular cirri and 4 eyes; neither has tentacles. (Note Webster's discovery of tentacles in *H. proctochona.*) *H. vittigera* has 15 setigerous segments, *H. proctochona* has 16; the ante-anal segment in the former has long cirri, while in the latter it is setigerous. (Note, again, Webster's description of this segment in *H. proctochona*, which removes this distinction.) Ehlers's pl. 41, fig. 1, shows unmistakably 16 bundles of setæ, which leads to the suggestion that possibly there might have been an error in the description. It seems probable that the two may agree in this respect. *H. vittigera* has two unequal, lip-like projections on the dorsal surface of the parapodium, which are absent in *H. proctochona*. (Note, again, Webster's description of one such lip in the latter.) There are no conical projections surrounding the anal opening in *H. vittigera*, as described for *H. proctochona*.

The Porto Rico collection contained a large number of specimens of this genus, which show so many resemblances to both the above species that it is very doubtful if the two are distinct. Number of setigerous segments, 16. There are eight pairs of tentacular cirri, four eyes, and two very rudimentary antennæ, visible only on very careful examination. Dorsal surface marked with transverse brown lines, leaving a broader white band at anterior end of each segment. The outer angle of the parapodium bears two short lips. These may be nearly equal in size, or one may be very small and easily overlooked. The ante-anal segment bears no setæ, but two long cirri. In favorable specimens the edge of the anal funnel is seen to be drawn out into conical processes, though the structures were lost in most of the specimens.

The Porto Rico specimens agree with *H. proctochona* in the number of setigerous segments, in the possession of rudimentary antennæ, and in having lobes on the anal funnel. They agree with *H. vittigera* in having two lobes to the dorsal parapodial lip, the smaller being frequently very small. In all other respects they agree with both species. Since, except in the first of the above-described features, the differences are points which might easily escape detection, I am convinced that the species are identical, and have included all of the Porto Rico specimens of *Hesione* under the species *H. proctochona.*

Under the name *H. prætexta*, Ehlers describes another species differing from *H. vittigera*, in having longitudinal instead of transverse brown marking, and in having but a single dorsal lip to the parapodium. Two specimens from Porto Rico show these longitudinal markings, but agree in the structure of their parapodia with *H. vittigera*. Ehlers suggests that the differences between *H. vittigera* and *H. prætexta* are merely sexual. This suggestion is probably correct.

Collected from Arroyo, Mayaguez, Hucares, Boqueron Bay, Playa de Ponce reef, Ensenada Honda (Culebra), Guanica Bay, Fajardo, Puerto Real, Porto Rico, Ponce, stations 6072, 6080, 6092, 6096, 6098.

The last specimen had fifteen setigerous segments and the markings of *H. prætexta*.

PODARKE Ehlers.

Podarke agilis Ehlers.

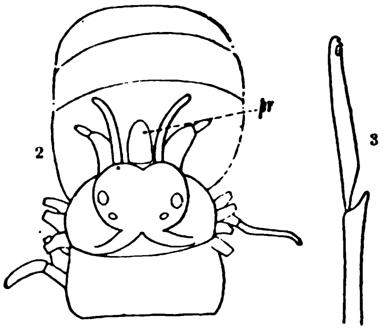
Podarke agilis Ehlers, Die Borstenwürmer, p. 197, pl. 8, figs. 9-11.

A single specimen I have referred, rather doubtfully, to this species. The anterior end was mutilated, so that it was impossible to compare the cirri with Ehlers's description. The median antenna is proportionately longer than in Ehlers's description, and the number of body segments greater. Collected from Puerto Real.

CASTALIA Sars.

Castalia longicirrata, n. sp.

Head roughly shield-shaped, its posterior end prolonged into two diverging processes. (See fig. 2.) Antennæ delicate, a trifle longer than palps. Palps 2-jointed, terminal joint conical, narrower than basal. When proboscis is protruded the head abuts on a conical process borne on dorsal surface of proboscis, which looks, in surface view, like a very thick median antenna. (Fig. 2, *pr.*). Four eyes, the anterior nearly twice as large as posterior. Body of 19 segments. Anteriorly, dorsal ramus of parapodium not more than one-third the length of ventral and much narrower. Toward the posterior end the ventral rami increase very much in thickness and the difference between the two is more pronounced. Each has a stout, black aciculum. Setæ of ventral bundle compound. (Fig. 3.) Those of dorsal bundle long, acicular, transversely striated, minutely serrated near the end. The eighteenth segment without parapodia, but, I think, with cirri. The posterior end was too badly mutilated to determine this point with certainty. Two anal cirri. Ventral cirrus reaching beyond tip of parapodium. Dorsal cirrus very long, in length equaling four times the diameter of the body.



Figs. 2, 3.—*Castalia longicirrata*. Fig. 2, Head, × 14; *pr*, process on proboscis. Fig. 3, Compound seta, × 95.

Color pale yellow, with marked iridescence. An indication of transverse markings could be seen on most of the segments, looking as if the color originally present had been removed by the alcohol.

Collected from station 6079.

Castalia mutilata, n. sp.

Head much broader than long, with anteriorly a median "tongue" marked off by two very indistinct lines. (See fig. 4.) With high power two very delicate processes may be seen at anterior edge (fig. 4, *ant?*); these I interpret as rudimentary antennæ. Palps 2-jointed, terminal joint much longer than basal. Eyes four, the anterior considerably larger than posterior pair. Six pairs of tentacular cirri. Body of 53 segments, broadest anteriorly, and narrowing gradually toward posterior end. Length, 17 mm. Greatest width, 1.5 mm.

Parapodium uniramous, with long conical anterior lip and shorter and more rounded posterior one. Setæ in two bundles, all compound, terminal article of most ventrally-placed setæ considerably shorter than those of dorsal ones. A delicate ventral cirrus is situated about a quarter of the length of parapodium from its end and reaches to the end of the posterior lip. The dorsal cirrus is very much stouter, placed nearer the body. The terminal articles of all the dorsal cirri and anal cirri had been broken away.

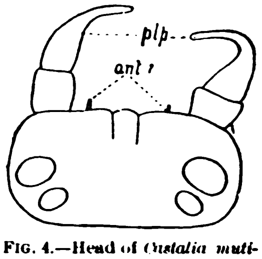


Fig. 4.—Head of *Castalia mutilata*, × 26. *ant?*, antennæ; *plp*, palps.

Collected from San Antonio bridge, San Juan.

I have identified these last two specimens as belonging to the genus *Castalia* from Ehler's diagnosis, Die Borstenwürmer, p. 187.

Family POLYNOIDÆ.

In the following descriptions I have followed Johnson's (Proc. Calif. Acad. Science, vol. 1, No. 5, p. 165) diagnosis of the genera *Polynoe* and *Harmothoe*.

HARMOTHOE Kinberg.

Harmothoe polytricha Schmarda.

Polynoe polytricha Schmarda, Neue Wirbellose Thiere, I, II, p 156. Ehlers, Annelids of the Blake, p. 49; pl. 10, figs. 9, 10; pl. 11, fig. 1.

A number of much mutilated specimens, comprising only a few of the most anterior segments and destitute of elytra and dorsal cirri. From the form of the head, parapodia, and tentacles, I have identified them with this species. Ehlers figures only two eyes. These have, in addition, two lateral eyes much larger than the others, and on the side of the head, where they might easily be overlooked.

Collected from stations 6079, 6091, 6070, and Mayaguez Harbor.

POLYNOE Sav.

Polynoe brevisetosa Kinberg.

Polynoe brevisetosa Johnson, Proc. Calif. Acad. Sci., vol. 1, No. 5, p. 167; pl. 6, fig. 24; pl. 7, figs. 31, 40, 40*a*; pl. 8, figs. 46, 46*a*.

For references to earlier literature see p. 167 of Johnson's paper.

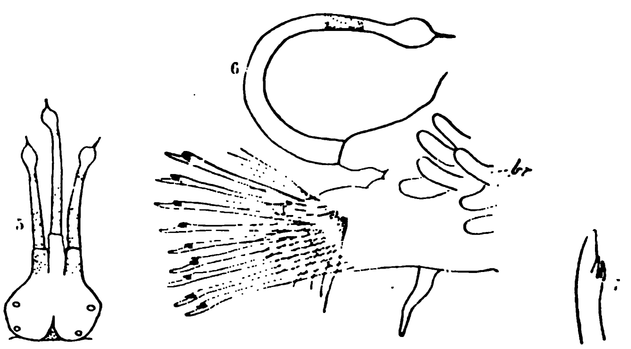
Collected from Puerto Real, Porto Rico, Caballo Blanco Reef, and Guanica Bay.

Polynoe branchiata, n. sp.

Head roughly hexagonal (see fig. 5) with anterior eyes at outer angles. Basal joint of antenna extending a little beyond that of tentacles. Terminal joint of antennæ reaching considerably beyond tentacles. Antennæ and tentacles brown for over half their length, then a white band, then a second brown band, immediately under the white, swollen end. A delicate acute tip terminates antennæ, tentacles, and all cirri. Peristomial cirri shaped like tentacles, with two brown bands, one about half way along their terminal joint, the other just beneath the swollen tip. Dorsal and anal cirri like peristomial, but with only one brown band. Palps long, conical, covered with fine, hair-like papillæ.

Twelve pairs of elytra. Surface of elytra covered with minute tubercles, with a number of softer, larger, papillæ near outer margin. Lateral and posterior margin densely fringed, with a longer tuft a little to one side of median plane of body on many of elytra. Elytra completely cover the body, and the tubercles and filaments give it an appearance of being covered with fine gray sand.

Parapodium with dorsal bundle of rather long setæ, toothed on both edges, and a ventral bundle of very stout, dark-brown setæ (see fig. 6). Each of the latter ends in a blunt point and carries at a little distance from its end a transverse row of sharp teeth. One or two of these are much stouter than the rest (fig. 7). Dorsally either an elytrophore or a very long dorsal cirrus (fig. 6). Ventrally a long narrow cirrus. Between each pair of parapodia, fastened to anterior wall of parapodium, to body wall, and a few to posterior wall of anterior parapodium are a number (ten or more) of finger-shaped processes (gills). (See fig. 6, *br.*) These appear first between the third and fourth setigerous segments and are found throughout the greater part of body. Proboscis smooth with a row of dorsal and ventral papillæ around distal opening.



FIGS. 5-7.—*Polynoe branchiata.* Fig. 5, Head, × 9. Fig. 6, Parapodium, × 16; *br*, branchiæ. Fig. 7, Ventral seta, × 90.

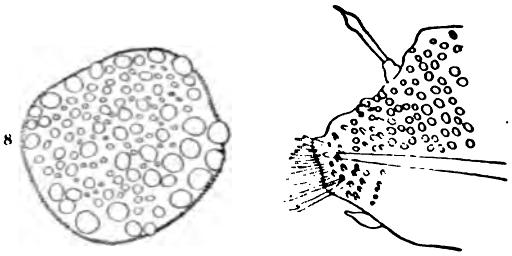
Length, 25 mm.; width, 8 mm. Another specimen: Length, 20 mm.; width, 6 mm.

Collected from Boqueron Bay, Ponce, station 6065.

Polynoe nodosa, n. sp.

Body plump, with short parapodia. The specimens with elytra removed are coiled, and look not unlike the larva of a coleopterous insect. General body color gray, with dark longitudinal dorsal band. In one of the two specimens at my disposal this is due to color of body wall; in the other, to the color of minute tubercles which cover it. Whole dorsal surface, even of parapodium, studded with small round tubercles. No tubercles ventrally, but surface is studded with fine papillæ, giving it a villous appearance. Head with lateral edges rounded. Breadth about equal to distance from posterior margin to base of antennæ. Anterior eyes larger than posterior and situated more toward side of head. Antennæ longer than head, with terminal swelling and acute tip. Tip of terminal swelling and subterminal band white; the rest brown. Tentacles not half as long as antennæ, like the latter in form and color, but lacking subterminal band of white. Tentacular and dorsal cirri like antennæ. Palps nearly twice as long as tentacles, tapering slowly to near apex, ending abruptly in a sharp point. Basal half colorless, terminal half brown. Surface studded with very minute papillæ, visible only under high power. In a smaller specimen, about half the length of the above, the palps were uniformly brown and only a little longer than the antennæ.

Elytra on segments 2, 4, 5, 7, etc., 23. Whole number of pairs, 12. Body segments 27, including anal segment. Only the anterior pair of elytra present in either specimen. These were nearly square, the edge with a row of fine papillæ, surface studded with tubercles. (See fig. 8.)



FIGS. 8, 9.—*Polynoe nodosa.* Fig. 8, Elytron, × 20. Fig. 9, Parapodium, × 15.

Parapodium uniramous, very thick, its dorsal surface covered with tubercles. (See fig. 9.) Toward the end, and ventrally, the tubercles are replaced by fine villous-like papillæ; dorsally, an elytrophore or cirrus. Short, stout, ventral cirrus. A few (ten) very strong setæ, with blunt-pointed apex; a single large tooth some distance from apex. Basal part striated longitudinally. A single large aciculum.

Length 25 mm; width 5 mm. Of another, length 15 mm., width 3.5 mm.

Collected from Fajardo and station 6079.

Polynoe, sp.

From Mayaguez was collected a fragment, probably a *Polynoe*, but owing to loss of the anterior segments this could not be determined with certainty. An elevated dorsal ridge marks off three distinct areas of the body—a median and two lateral. Surface irregularly marked with light brown and gray. Elytra transparent, not covering entire dorsal surface.

STHENELAIS Kinberg.

Sthenelais simplex Ehlers.

Sthenelais simplex Ehlers, Annelids of the Blake, p. 60, pl. 13, figs. 2 and 3; pl. 14, figs. 1 to 6.

Ehlers says there are no eyes. These, which agree in all other respects with his diagnosis, show a pair of very small dark eyes, one on either side of the base of the antenna.

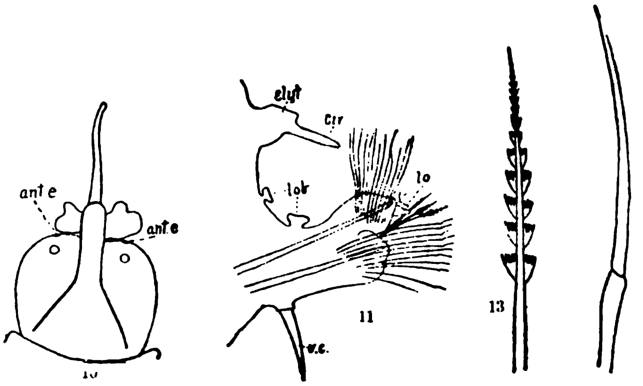
Collected from station 6066.

Sthenelais grubei, n. sp.

Grube, in his diagnosis of this genus (Annulata Semperiana, p. 54), says that the elytra are borne on segments 2, 4, 5, 7, etc., alternately to segment 23, and on every segment posterior to that. Schmarda (Neue Wirbellose Thiere, p. 146) states that the alternation ceases on the twenty-seventh segment. The specimens here described agree with Schmarda's description. The head (fig. 10) is rounded, with a rather broad median fissure into which the antenna fits. Base of antenna with broad lateral flap, narrower at base. Palps as long as first nine segments.

Elytra white, semitransparent. First pair broad kidney-shaped; others approximately oval, the outer posterior border fringed with a few delicate papillæ. As far as segment 27 there is a narrow dorsal area not covered by the elytra.

First parapodium with a pair of long cirri and with long delicate setæ minutely serrated along the edges. Other parapodia with a pointed ventral cirrus. (Fig. 11 *v. c.*) On segments without elytra a broad dorsal cirrus; on those with elytra the elytrophore carries a narrow cirrus on its outer surface (fig. 11 *cir*). Lobes of parapodium thick, blunt. Setæ on dorsal lobe arranged in a row; those on ventral lobe in a partial spiral. End of lobe prolonged into leaf-like processes. Similar processes may occur on dorsal surface of parapodium. (Fig. 11 *lob.*) In this figure of the parapodium no attempt has been made to represent the curved arrangement of the ventral setæ. Dorsal setæ long, capillary, with delicate serrations along their edges. Ventral setæ of two kinds; first compound, with long, smooth, terminal joint (fig. 12); second, few in number, complexly fringed along their edges (fig. 13).



Figs. 10-13.—*Sthenelais grubei.* Fig. 10, Head, × 21; *ant. e.*, anterior eyes. Fig. 11, Parapodium, × 18; *v. c.*, ventral cirrus; *cir.*, dorsal cirrus; *elyt.*, elytrophore; *lob.*, processes on parapodium. Fig. 12, Compound ventral seta, × 143. Fig. 13, Complex ventral seta, × 143.

Pharynx, when everted, with an upper and lower "valve," each with eleven papillæ. Two brown teeth above and below. There are two anal cirri. In some specimens many of the anterior elytræ bear orange-colored pigment spots.

This is apparently closely related to *S. luxuriosa* of Grube (Annulata Semperiana, p. 54), but differs in fringing of elytra and in structure of setæ. One specimen of 28 segments was 14 mm. long. None were complete, some bottles containing only anterior, others only posterior ends.

Collected from stations 6057, 6059, 6061, 6062, 6063, 6073; Puerto Rico, Boqueron Bay, and San Antonio Bridge, San Juan.

PSAMMOLYCE Kinberg.

Psammolyce rigida Grube.

Psammolyce rigida Grube, Verhand. d. Zool.-Botan. Gesellschaft in Wien, 1868, p. 631, pl. 7, fig. 1. Quoted from Grube, Annulata Semperiana, p. 55, 1878.

Collected from station 6062.

PANTHALIS Kinberg.

Panthalis oculea, n. sp.

Head globular, prolonged anteriorly into two eye-stalks, which carry the enormous eyes (fig. 14). Three tentacles, the median on anterior margin of head, the paired beneath the eye-stalks and projecting beyond their ends. Apex abruptly narrowed, giving rise to moderately long filament, longer than terminal filament of unpaired. Palps long, tapering, surface covered with minute filiform processes.

First parapodium with two long cirri, ending like the unpaired antenna, and nearly as long as the palps, but more slender, and smooth. Palps and cirri with numerous brown dots. A tuft of setæ on dorsal surface of first parapodium. A brown marking at base of unpaired antenna and a transverse brown band at posterior edge of head. Smaller pair of eyes near base of antenna.

Elytra on segments 2, 4, 5, 7, etc., through as much of the body as was preserved. Elytra nearly round, small, leaving the greater part of the body uncovered, their surface divided by fine lines into nearly equal, rectangular "cells." A brownish pigment in many of these spaces, with a tendency to accumulate in greater amount toward dorsal and posterior edges. Two specimens, otherwise indistinguishable from the others, showed no pigment on the dorsal surface of elytra and the posterior edges of the latter were black.

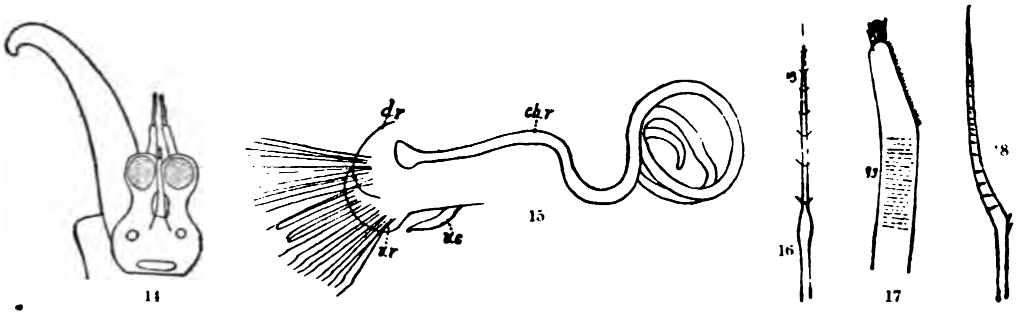
Pharynx, when extruded, as long as first 20 segments, with a smooth surface; at end with a dorsal and ventral "valve," each fringed with papillæ, of which the dorsal and median ventral are much the largest. Two powerful teeth in each jaw, a row of smaller teeth running laterally on either side of each.

On ventral view of the entire animal a series of black coiled structures may be seen lying one on either side the median line in either segment. If the parapodium be cut off, these structures pull out of the body, remaining attached to tip of parapodium by a flat expansion. (Fig. 15, *ch. r.*) Each is a chitinous rod, which easily splits up into a number of fine threads. Dissection shows that the first septum appears between segments 21 and 22, the coelom in front of that being a continuous cavity. This cavity is nearly filled by these rods, which are shorter and much less coiled than they are farther back. They lie just above the nephridia, which can be seen below them as slender, short, white organs.

Rami of parapodium almost fused. Dorsal ramus (fig. 15, *d. r.*) rounded, thin, with a tuft of long setæ; a few larger than the others, lanceolate at end, with a number of pairs of lateral spines (fig. 16). Ventral setæ of two kinds; dorsal ones thick, brown, with end obliquely truncated, and covered with minute spines. (Fig. 17.) Ventral ones colorless, not more than one-fourth as thick as the dorsal, bent at some distance from end, with the transverse diameter somewhat greater at point of bending; from the bend to apex covered with transverse rows of minute spines. (Fig. 18.)

About 55 of anterior segments preserved in one specimen measured 17 mm. in length, 2 mm. broad without parapodia, 4 mm. with parapodia.

Collected from stations 6059, 6063, and Porto Rico.



FIGS. 14-18.—*Panthalis oculea*. Fig. 14, Head, × 14. Only the left palp is figured. Fig. 15, Parapodium, × 14; *d. r. v. r.* dorsal and ventral rami; *v. c.*, ventral cirrus; *ch. r.*, chitinous rod. Fig. 16, Seta of dorsal ramus, × 143. Figs. 17 and 18, Setæ of ventral ramus, × 143.

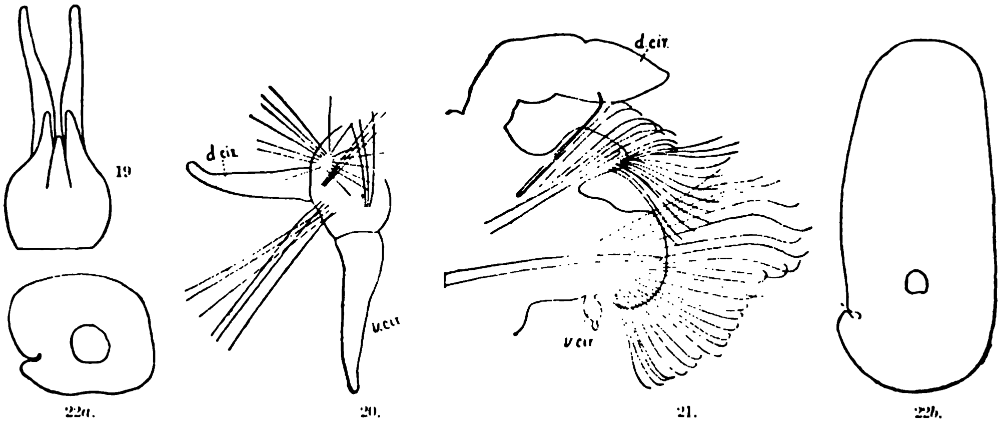
EULEPIS Grube.

Eulepis splendida, n. sp.

Head rounded, incised in front, unpaired tentacle small, rising from dorsal surface of head, reaching scarcely to half the length of the paired; the latter arising from anterior lobe of head, about two-thirds as long as head (fig. 19). All antennæ conical, with distal two-thirds dark brown, the very tip white. Palps long, smooth, white, tapering gradually to the end (fig. 19). No eyes could be seen.

First parapodium with two cirri and two tufts of delicate setæ (fig. 20) arising from its surface. Parapodium twisted so that the two cirri come to lie very nearly in a horizontal plane. Setæ long, thread-like, a few with very minute serrations along one border. Other parapodia with very distinct rami. Dorsal ramus with about 15 stout, brown, chitinous setæ, curved at apex, the curved portion pointing backward. Below this is a tuft of fine thread-like setæ, some with fine serrations along their edges. These are very numerous and of a golden-red color. Ventral ramus broader than dorsal, with about 25 long setæ. Setæ about half the diameter of coarse dorsal setæ, curved at apex, the curved portion pointing backward. General color of these setæ yellowish brown, with tips, as seen in reflected light, noticeably lighter. Ventral cirrus ovate with base slightly narrowed, its apex drawn out into a terminal joint having much the form of the basal, but very much smaller. Dorsal ramus with either a cirrus or an elytrophore (fig. 21).

Elytra borne on segments 2, 4, 5, 7, etc., 21, 24. Grube, in his diagnosis of this genus (Annulata Semperiana, p. 51), says that elytra alternate anteriorly, after the manner of the *Polynoidæ*, but posteriorly are borne on all segments. In his description of *E. hæmifera* (loc. cit., p. 52), he notes that the elytra are found on segments 2, 4, 5, 7, etc., up to 21; that then they skip first two, then three, and from the twenty-eighth segment are found on all segments. He notes further that the elytra increase in size up to the twelfth pair, and then become smaller. In *E. splendida* there are twelve pairs of elytra, the last much the largest, borne on segment 24, but extending back so as to cover as far as greater part of segment 31, and the above generic description—that all of the posterior segments bear elytra—applies only if we regard the broad, flat expansion of the dorsal cirrus as an elytron (fig. 21). This can hardly be the case, since it is found on all the cirrus-bearing segments, except the most anterior ones. In this respect these specimens do not agree with Grube's diagnosis. They agree in so many other respects, however, that I have no hesitation in assigning them to this genus. Probably the loss of posterior elytra is correlated with the enormous development of the twelfth pair.



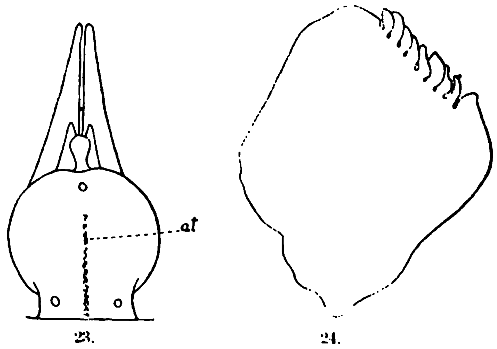
FIGS. 19-22b.—*Eulepis splendida*. Fig. 19, Head, × 17. Fig. 20, First parapodium, × 23; *d. cir.* and *v. cir.*, dorsal and ventral cirri. Fig. 21, Posterior parapodium, × 17. Figs. 22a, 22b, Seventh and twelfth elytra, × 8.

Parapodia around head very much crowded together; the second and third segments fused dorsally, so that the second elytrophore apparently arises from anterior end of third segment. The first elytra completely cover the head.

The first elytra were removed in order to draw the head, and were unfortunately lost before they could be drawn. A drawing of the seventh is given in fig. 22*a* and of the twelfth in fig. 22*b*. These are drawn to the same scale, to show the increase in size from before backward. Except a small notch on outer border, the edge is entire. Their color is white, and they show, under the microscope, a finely granular texture. At anterior edge of ventral ramus of parapodium is a dark spot.

Body of 37 segments. Length, 37 mm. Width without parapodia, 3 mm.; with parapodia, 5 mm. The single entire specimen had one anal cirrus.

Collected from stations 6062 and 6065.



FIGS. 23, 24.—*Eulepis fimbriata*. Fig. 23, Head, × 18; *at*, line along which process from anterior elytrophore fuses with head. Fig. 24, Elytron, × 22.

Eulepis fimbriata, n. sp.

Head rounded (fig. 23). Antenna small, globular, on a short stalk. Tentacles reaching a little beyond tip of antenna, rising from under surface of head. Palps long, smooth, closely appressed in middle line. Head thickly marked with yellowish brown. Two dark spots (eyes?) near base and one toward apex just behind base of antenna. All appendages around the head very much crowded together. The anterior elytra completely cover the head, their elytrophores touching on median line. An anterior process from base of elytrophore fuses with dorsal surface of head. (See its line of attachment *at*, in fig. 23.) Parapodia and setæ like those of *E. splendida*, except that setæ of dorsal ramus are possibly not so numerous and lack the brilliant color characteristic of the latter. Second and third segments more or less fused above. Arrangement of elytra as in *E. splendida*, the twelfth pair much the largest, borne on segment 24 and covering nearly all the rest of body.

Elytra white, granular, like those of *E. splendida*, but prolonged on lateral border into broad leaf-like processes (fig. 24). One anal cirrus. Number of body segments, 37.

Length, 24 mm.; width, without parapodia, 4 mm.

Collected from station 6061.

Family PHYLLODOCIDÆ.

PHYLLODOCE Sav.

Phyllodoce oculata Ehlers.

Phyllodoce oculata Ehlers, Annelids of the Blake, p. 135, pl. 40, figs. 4, 5, 6.

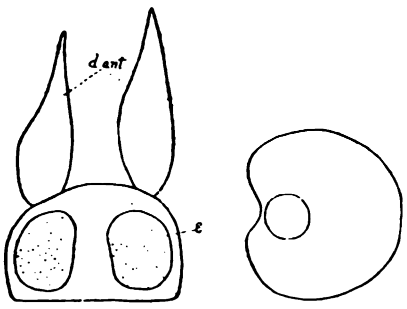
According to Ehlers, the ventral cirrus in each segment is fused along its whole dorsal edge to ventral face of parapodium. In the specimen from Porto Rico, although the cirrus is closely apposed to the parapodium, it is actually fused only at its base. Ehlers describes, further, the parapodium as uniramous, with an anterior and a posterior lip, the latter being the larger and bifid at end. In these it is the anterior lip which is larger and bifid.

Through the courtesy of Dr. W. M. Woodworth, I have had an opportunity of examining the type specimen from the Museum of Comparative Zoology at Cambridge, Mass., and I find that Ehlers was certainly wrong in both the above points. The ventral cirrus in the type specimen is attached only at its base, and the anterior lip is larger and bifid. In all other respects the Porto Rico specimens agree with Ehlers's diagnosis of the species.

Collected from station 6065.

Phyllodoce magna-oculata, n. sp.

Head rounded, broader than long (fig. 25). Eyes very large (*e*, fig. 25). Dorsal antennæ lanceolate, nearly twice as long as head (*d. ant*, fig. 25). Ventral antennæ on lower face of head, equal in size to dorsal. Four pairs of tentacular cirri, the largest 3.5 times as long as the antennæ, thick, with acute termination. The other cirri smaller, equal.



25. 26.

FIGS. 25, 26.—*Phyllodoce magna-oculata*. Fig. 25. Head, × 70; *d. ant.*, dorsal antennæ; *e*, eye. Fig. 26. Gill, × 70.

The gills had all been removed from the anterior segments of the body. Those which remained were covered with a slimy deposit, containing numerous foreign particles. The gills are especially liable to be broken away in attempting to remove this deposit. Gills broadly reniform (fig. 26), with entire margin and with point of attachment near the base of the hilus. Color at point of attachment, light brown. Each gill contains numerous anastomosing blood vessels and numerous small, round, light and dark brown pigment granules.

Parapodium a single conical lobe, slightly bifid at the end, with a large aciculum. About nine compound setæ on either side of the aciculum. Basal joint of setæ long, most extending nearly or quite the length of parapodium beyond tip of latter. At end the basal portion has a club-shaped enlargement, marked by very fine longitudinal lines. Terminal portion rather more than half as long as basal, at base as broad as basal portion, tapering gradually to a fine point.

Collected from station 6067.

Phyllodoce, sp.

From Boqueron Bay was obtained a fragment of a specimen of this genus too much injured for identification, head and tail lacking. The fragment was 25 mm. long, 5 mm. wide, and contained over 50 segments. Body black, with a dorsal longitudinal band, and edges of gills and cirri fringed with white.

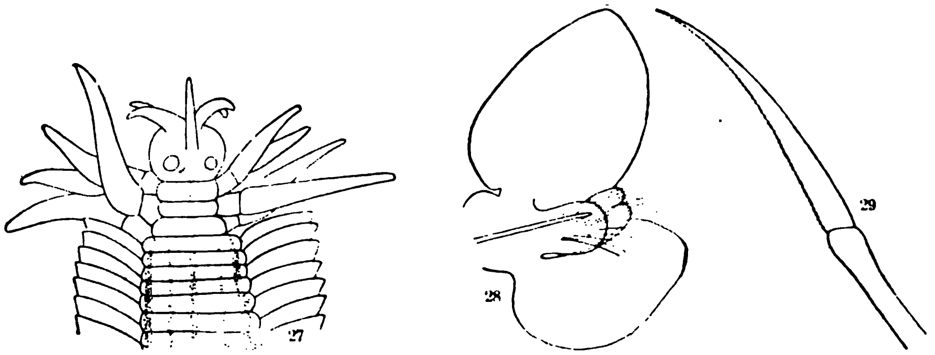
EULALIA (Sav.) Malmgren.

Eulalia quinquelineata, n. sp.

Head oval, broadest just in front of eyes, with a slight constriction at base of tentacles (fig. 27). Tentacles four, equal, three-fourths as long as head, stout, with acute points. Median unpaired tentacle arising about half way from eyes to the anterior margin of head, much more slender than paired and reaching beyond their ends. Two rows of small pigment spots begin at base of unpaired tentacle and extend back between eyes, forming an)(shaped marking.

On first segment, one tentacular cirrus; on second, two (a dorsal and a ventral); on third, a long dorsal, tentacular cirrus, and a thick, flat, ventral cirrus, the latter like the ventral cirri of succeeding segments. Tentacular cirri composed of a basal portion and a stout terminal portion pointed at end. Dorsal cirrus of second and that of third segments about equal in size and slightly larger than other two. First and second segments about two-thirds the diameter of the fourth and succeeding segments.

Body 450 mm. long; without the parapodia 2 mm. wide at anterior end. It retains this width until near posterior end, where it narrows gradually. No anal cirrus present in the single specimen in this collection. Segments at anterior end six times wider than long; toward posterior end this proportion is diminished and the parapodia of successive segments are more widely separated than anteriorly. In the preserved specimen, which is doubtless more or less contracted, the gills of each segment overlap those of segment in front. On account of the great length of the body and the extent to which it was coiled I was unable to determine the precise number of the segments. Since the length of the anterior segments is only about 0.33 mm., increasing slightly toward posterior end, it follows that there must be at least 1,300 segments in the whole body.



FIGS. 27-29.—*Eulalia quinquelineata*. Fig. 27, Head, × 7. Fig. 28, Parapodium, × 72. Fig. 29, Compound seta, × 257.

Parapodium a single ramus with anterior bilobed lip and posterior shorter, rounded, one. Dorsal cirrus nearly a regular ovate, attached by ventral joint (fig. 28). Ventral cirrus comparatively large, ovate, hollowed out on side next parapodium. Both cirri show numerous ramifications of blood vessels in their interior. Toward posterior end the cirri become a trifle more acute at ends and the whole appendage is much smaller, but their relative proportions are about the same. Setæ compound, the basal joint long, swollen at end. Terminal joint broad at base, bent slightly and tapering gradually to an acute point, with row of minute teeth on concave edge (fig. 29).

Color of body yellowish brown, with a faint greenish tinge. Dorsal surface with five longitudinal black bands—a median, two admedian, and two lateral, the latter just at base of parapodia. Median narrow on first five segments, becoming broader farther back. Lateral narrower than median, beginning on third segment. Admedian about half way between the other two, a little nearer the lateral; narrower and lighter colored than either. They begin on posterior edge of fourth segment as small spots, which are repeated on fifth and sixth segments, becoming continuous lines on seventh (fig. 27). Toward posterior end this line becomes much less conspicuous. On ventral surface a median and two lateral bands, similar in size and position to corresponding dorsal ones, but with no admedian bands.

Collected from Hucares.

Family NEREIDÆ.

NEREIS Cuvier.

Nereis bairdii Webster.

Nereis bairdii Webster, Annelids from Bermuda, Bull. No. 25, U. S. Nat. Mus., p. 312, pl. 8, figs. 22-28.

There are apparently two-well marked varieties in this species, differing in color and in form of parapodia. One with outer portion of head and dorsal surface of anterior segments brown. A row of colorless spots in this band on head and across anterior end of first six or seven segments. Parapodia, especially the posterior ones, with excessive development of dorsal ramus, as described by Webster. A rectangular white patch on dorsal surface of each pair of segments, overlapping the line between the two, though lying mainly in posterior one. The second variety has a band of brown around the head, much narrower than the first and with no white spots. A transverse brown band on each segment, much darker near posterior edge. Lobes of parapodium much blunter and more rounded than in first variety and posterior parapodia not with excessive development of dorsal ramus. Dorsal cirri much longer than in first variety. Webster figures long compound setæ with smooth terminal joint. In the Porto Rico specimens this terminal joint is finely toothed. These specimens agree so closely with one another, and with Webster's description of the species, in so many anatomical features, that I have thought it best to regard them as color varieties of the same species.

Collected from Puerto Real, Arroyo, Boqueron Bay, Mayaguez, Porto Rico, stations 6065, 6091, 6092, 6062, and 6063; Ensenada Honda, Culebra.

Nereis mirabilis Kinberg.

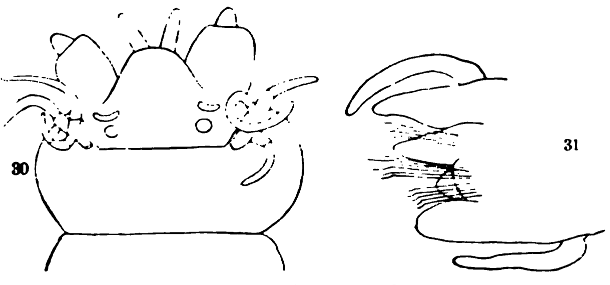
Nereis mirabilis Kinberg, Annulata Nova, Oefvers. af. K. Vet. Akad. Förh. 1864, No. 16, page 571. Quoted from Ehlers, Annelids of the Blake, p. 117, pl. 37, figs. 1-6.
Nereis gracilis Webster, Annelids from Bermuda, p. 313.

From a careful comparison of Ehlers's with Webster's description I conclude that these are identical species. Ehlers figures the antennæ as entire, while Webster figures them with rather long basal joints. The single specimen at my disposal (from Boqueron Bay) has a short basal joint, easily overlooked in preserved material.

Nereis arroyensis, n. sp.

Head broader than long, the dorsal surface shading off gradually into the palps, with no sharp line between the two. Anterior edge rounded, with two thick antennæ. Eyes four, anterior pair semilunar in form (with transparent "lens"?) (fig. 30). The posterior dorsal tentacular cirri had been lost; the other cirri short (fig. 30). In other specimens than the one figured these cirri were longer. Body colorless, broadest in front, tapering gradually to posterior end. Body of 73 segments. Two very long anal cirri. 45 mm. long, 2.5 mm. wide.

Parapodium with dorsal cirrus longer than ramus (fig. 31). Ramus of two lingulæ, the dorsal a little longer than the ventral. Setæ of dorsal ramus compound, with long basal joint with prominent transverse striations. Terminal joint long, nearly straight, finely toothed. Dorsal setæ of ventral ramus like setæ of dorsal ramus. Ventral setæ with basal joint like dorsal, terminal joint short, hooked at end and with a row of long delicate spines on side. Dorsal lingula of ventral ramus with anterior and posterior lobe ("lip"), the anterior a little the larger. Ventral cirrus not quite so long as dorsal. Toward posterior end, parapodia much as anteriorly, except that lobes become a little more pointed, and the setæ with long terminal joint become relatively much more numerous in the ventral ramus. The number of setæ in the dorsal ramus becomes very small.



FIGS. 30, 31.—*Nereis arroyensis*. Fig. 30. Head, × 17. Fig. 31. Parapodium, × 18.

Collected from Arroyo and station 6052.

A single much mutilated specimen from Mayaguez I have placed in this species, though it is possibly distinct. The form of the head and palps was like that of *N. arroyensis*, as also was that of the posterior parapodia. The anterior 8 to 10 parapodia had very thick rounded lobes, showing only a division into the two rami.

Family NEPHTHYDIDÆ.

NEPTHYS Cuv.

Nepthys squamosa Ehlers.

Nepthys squamosa Ehlers, Annelids of the Blake, p. 128, pl. 37, figs. 7-10.

Collected from stations 6084, 6085, 6091, 6092, 6093.

Family AMPHINOMIDÆ.

HERMODICE Kinberg.

Hermodice caruneulata (Pall.) Kinberg.

Hermodice caruneulata Webster, Annelids from Bermuda, Bull. U. S. Nat. Mus. 1884, p. 307 (See this paper for reference to earlier literature.) Ehlers, Annelids of the Blake, p. 27.

The color varies from brown to a decided blue. Ehlers says the young are a light brown with a black mark across the back. Only one specimen of this collection (18 cm. long) showed this marking.

Collected from Guanica Bay, Fajardo, Arroyo, Ponce, San Antonio Bridge, San Juan, Boqueron Bay, Mayaguez, Playa de Ponce Reef, Ensenada Honda (Culebra), stations 6092, 6088.

NOTOPYGOS Kinberg.

Notopygos crinita Grube.

Notopygos crinita Grube, Beschreibung neuer oder wenig bekannter Anneliden, Archiv. f. Natur. Jhr., 21, Bd. 1, 1885. Grube, Annulata Semperiana, 1878, p. 7. Ehlers, Annelids of the Blake, p. 24, pl. 1, fig. 3; pl. 3, figs. 5, 6, 7.

A very full description is given by Ehlers; he does not figure nor describe a row of small, bead-like elevations on the dorsal surface of the median fold of the caruncle; these are about 15 in number, very prominent in front, and gradually fading out behind; they are relatively more prominent in the large than in the small specimens. In a specimen 42 mm. long the first ten of these beads were dark brown. In smaller specimens only one or two show any color.

Collected from station 6079. From a second specimen the locality label was unfortunately lost in transferring.

EURYTHOE Kinberg.

Eurythoe complanata Pall.

Eurythoe complanata Pallas, Miscellanea Zoologica, Hagae-Comitum, p. 109, pl. 8, figs. 19-26. Quoted from Ehlers, Annelids of the Blake, p. 29.

Body light gray, with marked iridescence. Setae white. Ehlers describes the eyes as black; these were a light reddish brown.

Collected from Arroyo, Hucares, Puerto Real, Ensenada Honda (Culebra). In one other specimen the locality label was lost.

EUPHROSYNE Sav.

Euphrosyne triloba Ehlers.

Euphrosyne triloba Ehlers, Annelids of the Blake, p. 31, pl. 4.

Collected from station 6098.

CHLOEIA Sav.

Chloeia euglochis Ehlers.

Chloeia euglochis Ehlers, Annelids of the Blake, p. 18, pl. 1, figs. 1-8; pl. 3, figs. 1-4.

Two specimens are in this collection. Eyes not so nearly fused as in Ehlers's description. Median and paired antennae and most of the dorsal cirri are of a brilliant violet color.

AMPHINOME Brug.

Amphinome microcaruneulata, n. sp.

Body of single specimen incomplete, only anterior 36 segments preserved. Length of these, 38 mm. Breadth of head, 0.75 mm. Body rapidly widens to twentieth segment, where its breadth is 10 mm.;

from here it narrows again rapidly; thirty-second segment, 5 mm. wide. Color above, seal-brown, shading into ashy gray anteriorly; ventrally, ashy gray. Setæ long, very fine, white. Caruncle small, smooth, not extending beyond limits of head lobe. Dorsal setæ shorter than ventral. Dorsal cirrus arising at base of tuft of setæ, a little behind and ventral to them. Cirrus about three-fourths as long as setæ. Ventral ramus with a thick fleshy lip, from the dorsal edge of which the setæ arise. Ventral cirrus slender, shorter than lip of ramus. Two tentacles and two subtentacles present, the median tentacle having been lost. (See fig. 32.) No eyes could be seen. Mouth surrounded by two segments, the posterior lip lying in the interruption of median line of third segment. Gills appear first on eighth segment, as a single filament, attaining their full size about segment 12. They are very inconspicuous, lying behind the dorsal cirrus, and in preserved material almost completely hidden in the constriction between the segments. In its fully developed form each gill is composed of a tuft of thick, short filaments.

In the generic description of *Amphinome* (Kinberg; Svenska. Vetensk. Akad. Ofversigt, vol. 14, pp. 11 to 14, 1858) it is stated that the gills begin on segment 3. In the absence of a median tentacle and in the fact that the gills appear first on the ninth segment, this specimen differs from the generic diagnosis. I have regarded the former as an accident, and the latter as not of sufficient importance on which to form a new genus.

Collected from station 6070.

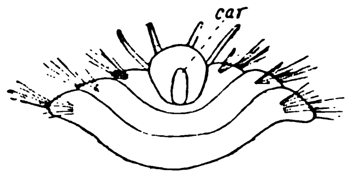


FIG. 32.—Head of *Amphinome microcaruncululata*. × 8; *car.*, caruncle.

Family CHRYSOPETALIDÆ.

BHAWANIA Schmarda.

Bhawania goodei Webster.

Bhawania goodei Webster, Annelida from Bermuda, p. 308.

A number of fragments, lacking both head and tail, seem undoubtedly to belong to this species, though the remaining parts differ somewhat from Webster's description. Dorsal and ventral rami of parapodia separated rather more widely than in Webster's description. Terminal portion of ventral ramus expanded at base and narrowing rapidly toward apex. Webster figures it as slender and conical. Dorsal ramus as in Webster's description. Dorsal paleæ in a row extending across back, the median ones bending inward, so that those of opposite sides overlap. Setæ of two kinds. Those of dorsal ramus constricted at base, like dorsal paleæ, and for inner two-thirds of their length marked with the longitudinal and transverse striations characteristic of latter. These are figured by Webster as smooth, with sharp point and broad base.

The setæ of the dorsal ramus are regarded by Johnson (Proc. Calif. Acad. Sci., vol. 1, No. 5, p. 162) as a second form of paleæ, and are one of the characters of his new genus *Heteropale*. The data in my possession are few, but from what I have I am inclined to believe that Johnson's *Heteropale* should be discarded in favor of Schmarda's *Bhawania*. In the shape and position of the other setæ, these specimens agree with *B. goodei*.

Ehlers (Annelids of the Blake, p. 34) describes fragments of a Chrysapetallid in which the paleæ cover the back. He does not describe any other details.

Collected from Arroyo.

Family EUNICIDÆ.

EUNICE Cuvier.

Eunice ornata Andrews.

Eunice ornata Andrews, Annelida Polychæta of Beaufort, N. C., Proc. U. S. Nat. Mus., vol. 14, p. 284, 1891.

Collected from stations 6080, 6079, 6073, 6092; Mayaguez; Ponce; stations 6086, 6091; and a female with eggs from Arroyo. In the specimen from station 6092 the gills began on the sixth segment, instead of the fifth, which, according to Andrews, is the normal.

Eunice denticulata Webster.

Eunice denticulata Webster, Annelida from Bermuda, Bull. U. S. Nat. Mus. 1884.

Webster's specimens, preserved in alcohol, were of a yellowish white color. One in this collection, preserved in formalin, was a dirty white through most of the body, dorsal surface of head and anterior segments irregularly marked with dark green blotches. Gills appear as single filaments on the twenty-eighth setigerous segment. Head deeply bilobed. Tentacles smooth, equal, about twice as long as the head. The dorsal ramus of the parapodium contains comb-shaped setæ, which are not described by Webster. The head of one large specimen was mottled with brown.

Collected from stations 6065, 6079, on corals at Mayaguez, and from Ensenada Honda (Culebra).

Eunice violacea-maculata Ehlers.

Eunice violacea-maculata Ehlers, Annelids of the Blake, p. 86, pl. 24, 1, figs. 11, 12; pl. 25, figs. 1-7.

Two long transversely banded anal cirri. Collected from Ensenada Honda (Culebra), and from station 6079.

Eunice articulata Ehlers.

Eunice articula Ehlers, Annelids of the Blake, p. 83, pl. 24, figs. 8, 9, 10.

Gills begin on the third setigerous segment. Ehlers says there are two anal cirri. These have four, two long, articulated, and two very short ones.

From Playa de Ponce reef was collected a specimen superficially very unlike Ehlers's description of this species, but agreeing so closely in most characters of importance that I have included it here. The differences are possibly sexual. The body is much larger and broader. General color, light brown. Segments 3, 7, 8, and 9 white. A narrow brown band at the base of each segment of antennæ and cirri. A smaller specimen from station 137 shows these same color markings.

Collected from stations 6065, 6098, 6096, and Playa de Ponce reef.

Eunice siciliensis Grube.

Eunice siciliensis Ehlers, Die Borstenwürmer, p. 353, pl. 16. (See Ehlers's paper for references to previous literature.)

In an animal of 350 segments the gills appear first as a simple fold on segment 145. Ehlers says that the distinction in length between the two pairs of anal cirri is not great. In the single perfect specimen in this collection two of these are much longer than the other two.

Collected from station 6064, Caballo Blanco reef, and Arroyo.

Eunice fucata Ehlers.

Eunice fucata Ehlers, Annelids of the Blake, p. 91, pl. 25, figs. 8-20.

Ehlers does not mention the presence of anal cirri. In one of these there are two long, rather fleshy cirri. Collected from Arroyo, Caballo Blanco reefs, and Boqueron Bay.

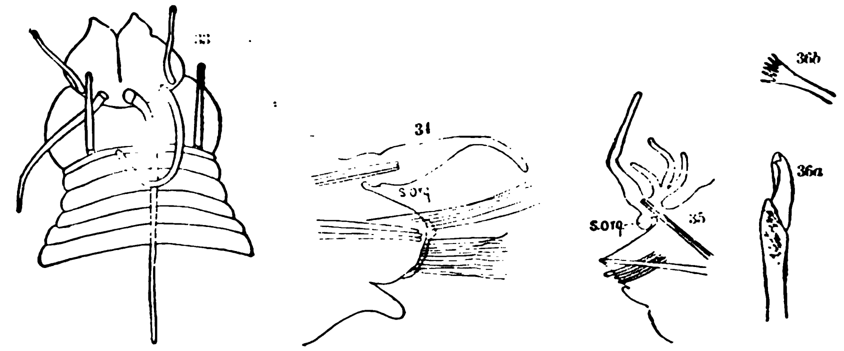
Eunice auriculata, n. sp.

Prostomium bilobed, each lobe triangular, with apex pointing forward. (See fig. 33.) This lobing is much more prominent on the ventral face. Tentacles composed of a short articulated basal portion and a long, smooth, terminal portion, the latter tapering gradually to the end. Median antenna very long, reaching back to the eighteenth segment. Median paired antennæ half as long as unpaired. Outer paired antennæ about half as long as median. Peristomium long at sides, deeply hollowed in front, so that median length is scarcely two-thirds that of side. Median length about equal to three succeeding segments. Third segment about equal in width to succeeding. Nuchal cirri smooth, tapering gradually from a rather thick base to a sharply-pointed apex. Apex reaching a little beyond front border of peristomium. The body gradually narrows to the fourth segment, and from here gradually increases in width to about the tenth. From there a gradual decrease again as far as thirtieth. Thirtieth segment a trifle narrower than the first. Dorsal cirri very large. Branchiæ begin on nineteenth segment as a single filament. On the twenty-first this has divided into two, and at about the twenty-seventh it divides again. They never become very complex.

Anterior parapodia blunt, with anterior and posterior lips, the former a little the longer and with a rounded lobe at its apex. (See fig. 34.) About 12 acicular setæ in the dorsal bundle and over 20 setæ in lower bundle. The latter with long, acute, terminal joint. Ventral cirrus short and fleshy;

farther back the parapodium becomes more pointed, and the division into anterior and posterior lips is not evident. (See fig. 35 of forty-fifth parapodium.) A stout dorsal aciculum and three smaller ventral ones bent and toothed at end. Aciculæ extend into the dorsal cirrus in all parapodia. Ventral cirrus stout and short on anterior segments (fig. 34); very small on posterior ones (fig. 35).

Setæ of posterior segments of three kinds. Some like those of anterior segments. In addition, comb-shaped setæ and compound setæ, with short toothed terminal joint. (See figs. 36*a* and 36*b*.) On the ventral surface of the dorsal cirrus is a peculiar rounded lobe, which I suppose must be a sense organ, though I have not yet had opportunity for a careful study of it. It is present, though very small, on the first segment, and becomes very prominent farther back. (See figs. 34 and 35, *s. org.*) It contains no pigment, so can hardly be optical in function. A more complete account is reserved for a later paper.[1] No eyes could be discovered on the alcoholic material. Jaws: 1, long, pointed; 2, right 4 to 5, left 6; 3, right 5, left 5. Dark brown spot on outer ventral side of 4.



Figs. 33–36*b*.—*Eunice auriculata*. Fig. 33, Head, × 12. Fig. 34, Anterior parapodium, × 19; *s. org.*, sense organ. Fig. 35, Forty-fifth parapodium, × 19. Figs. 36*a*, 36*b*, Setæ, × 143.

Color light brown. The posterior segments had been lost in all the specimens. The animals live in tubes of mud with thick (2 mm.) walls.

Collected from stations 6066 and 6067.

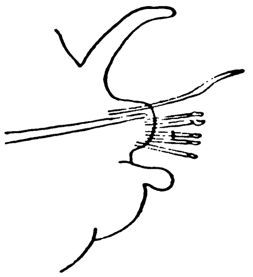


FIG. 37.—Parapodium of *Eunice culebra*, × 46.

Eunice culebra, n. sp.

The collection includes one small specimen which I at first took for a species of *Nicidion*. Only about 50 of the most anterior segments were preserved; the most posterior show a short outgrowth on each dorsal cirrus, representing a gill; it is evidently an immature *Eunice*. Head deeply bilobed, with a pair of eyes near bases of the inner paired tentacles. Tentacles slender, unpaired, three times as long as head. Median paired three-fourths as long as head. Outer paired a little shorter than median. Tentacular cirri slender, a little over half as long as buccal cirrus. Parapodium (see fig. 37) with a single stout aciculum. Dorsal cirrus long, ventral cirrus short, blunt, with a swollen base. Ventral setæ compound, terminal joint with a stout tooth behind apex. Dorsal setæ long, curved, pointed, slightly enlarged near the end.

I have been unable to identify this species, and have given it, provisionally, the above name.

Collected from Ensenada Honda, Culebra.

Eunice rubra Grube.

Eunice rubra Grube, Annulata Oerstediana, 1856–57, p. 59. Quoted from Ehlers, Annel. of Blake, p. 87, pl. 26, figs. 1-11.

Specimens very immature, but agreeing so closely with this species in structure of tentacles, setæ, and aciculæ that I have placed them here. From Arroyo, Puerto Real, and station 6085.

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[1] Later study shows that this organ is essentially identical in structure with the lateral line organs described by Eisig in the *Capitellidæ*. (Fauna u. Flora Golf v. Neapel, XVI, p. 76.)

Eunice, sp.

Fragments of *Eunice*, too much injured for identification, were collected from Arroyo; stations 6086, 6062, and 6663.

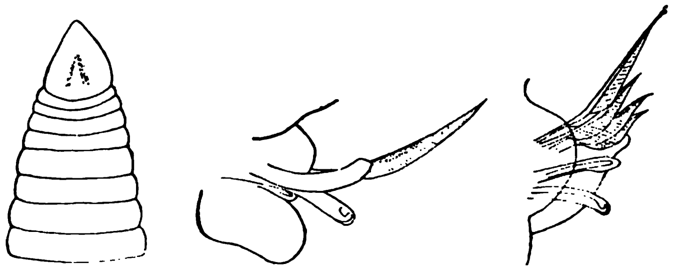
DIOPATRA Quatrefages.

Fragments of tubes, evidently belonging to this genus, were collected from station 6062.

LUMBRICONEREIS (Blainville) Ehlers.

Lumbriconereis parva-pedata, n. sp.

Head acute, about as broad as long. Dorsal surface marked by median longitudinal ridge. No eyes. (Fig. 38.) First two segments short and nearly fused, the line between them more apparent on the side than elsewhere; the two together only a little longer than the third. Junctions between anterior segments as far as ninth not marked by any prominent constrictions. From the ninth onward these intersegmental constrictions become very deep and the segments are much shorter, not more than half as long as broad. Width of body increases up to segment 10; then decreases slowly to segment 25; from here the diameter is nearly uniform, tapering gradually toward posterior end. Segments behind twenty-fifth a little longer than those in front.



38. 39. 40.

Figs. 38-40.—*Lumbriconereis parva-pedata*. Fig 38. Head, × 8.5. Fig. 39, Parapodium, × 143. Fig. 40. Posterior parapodium, × 57.

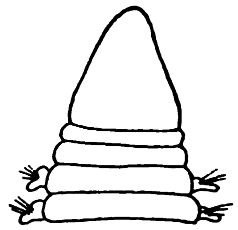


Fig. 41.—Head of *Lumbriconereis floridana*, × 18.

Parapodium of first segment very small, forming a mere knob on side of segment. Second parapodium a little longer, containing two or three stout, hooked setæ (see fig. 39), and two (only one shown in fig. 39) long, capillary setæ with broad, striated apex. Parapodia of anterior segments too short to be visible from a dorsal view. They gradually elongate toward posterior end, coming into view from above on the eighteenth segment. Parapodium of nineteenth segment (see fig. 40) has rounded anterior and more pointed posterior lips. Four dorsal broad capillary setæ and two ventral stout hooked setæ. The setæ of most of posterior segments had been lost, so that no data can be given concerning any variations that may occur among them.

Length, 200 mm. Width at anterior end, 2 mm.

Color in alcohol, light yellow, with yellowish brown bands crossing many of the segments. These bands are very irregularly distributed and may be portions of the color of the living animal which had not been entirely extracted by the alcohol.

Collected from Ensenada Honda, Culebra.

Lumbriconereis floridana Ehlers.

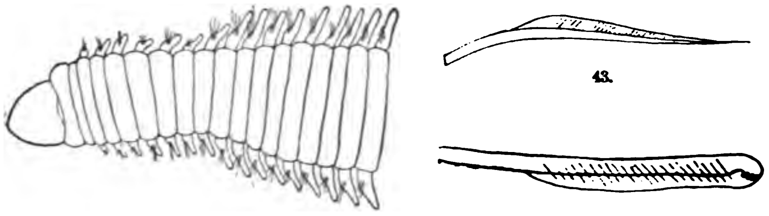
Lumbriconereis floridana Ehlers, Annelids of the Blake, p. 103, pl. 30, figs. 10 to 15.

Collected from Boqueron Bay and station 6065. From the latter locality was collected the anterior portion of another specimen, differing from Ehlers's diagnosis in the more pointed head lobe. (See fig. 41.) Since it agrees in other respects, I have included it in this same species.

Lumbriconereis maculata, n. sp.

Head rounded, a trifle longer than broad, as long as following three segments. Surface uniformly convex, with abrupt depression at posterior margin. No eyes. (Fig. 42.) First segment twice as long as second. First nine segments about five times as broad as long. Beginning with the tenth there is a marked increase in width up to the sixteenth. (See fig. 42.) Sixteenth and later segments about eight times broader than long. At about the ninetieth each segment becomes longer and narrower. Middle of each segment marked by a transverse sharp ridge. Intersegmental constrictions much deeper in posterior than in anterior segments.

Anterior parapodia rather short. Beginning with the second, each has a noticeable posterior lip. Farther back, the parapodia are nearly twice as long as anteriorly, but with essentially similar form. The change is rather abrupt, occurring, in one specimen on the sixth, in the other on seventh segment. Distal portion of setæ white, as seen with low power, in sharp contrast to darker proximal portion.


42.
43.
44.

FIGS. 42-44.—*Lumbriconereis maculata.* Fig. 42, Anterior portion, × 9.5. Fig. 43, Capillary seta, × 55. Fig. 44, Uncinate seta, × 110.

Setæ of two kinds. Capillary (see fig. 43) long, curved, with marginal expansion, the whole delicately striated. Setæ of other kind with stout, terminal hook (see fig. 44). The hook with four small teeth and with broad lateral expansion, involving the entire seta. Both forms are present in the anterior segments. At about segment 35 the second form becomes more prominent, and at segment 42 the capillary setæ disappear. The others, as seen under low power, have club-shaped ends.

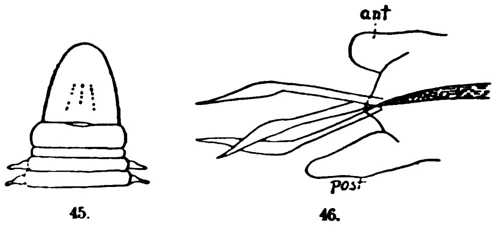
Color varies from chestnut brown on the posterior segments to light yellow on the anterior. Surface of body, especially on head and anterior segments, marked with irregular spots of dark brown.

Neither specimen was complete. The larger, of 112 segments, was 29 mm. long. The head was 1 mm. wide. Body, without the parapodia, 2 mm. at the widest part.

Collected from Puerto Real.

Lumbriconereis bilabiata, n. sp.

Head elongated, like that of *L. floridana.* (See fig. 45.) First segment longer than second. Succeeding segments of uniform breadth, about eight times broader than long. Anterior parapodia with rather prominent but very narrow posterior lip. Farther back a thicker anterior lip, nearly as long as the posterior, makes its appearance. (See fig. 46 of thirty-sixth parapodium.) The aciculum very strong, black. Setæ had nearly all been lost. Those of thirty-sixth segment were as figured. Specimen incomplete, of only 57 anterior segments.



45.
46.

FIGS. 45, 46.—*Lumbriconereis bilabiata.* Fig. 45, Head, × 13. Fig. 46, Thirty-sixth parapodium; *ant.*, anterior lip; *post.*, posterior lip.

Length, 13 mm. Greatest breadth, 1 mm.

Color, a uniform gray brown. Collected from station 6061.

ARABELLA (Grube) Ehlers.

Arabella opalina Verrill.

Lumbriconereis splendida Leidy, Marine Invert. Fauna of R. I. and N. J., p. 5, 1855.

Lumbriconereis opalina Verrill, Invert. of Vineyard Sound, Rept. U. S. F. C. for 1872, p. 594, pl. 13, figs. 69, 70, 1874.

Arabella opalina Verrill, Proc. Ac. Nat. Sci. Phila., p. 299, 1878. Webster Annelida Chætopoda of Virginia Coast, p. 242, 1879; Annelida Chætopoda of New Jersey, p. 116, 1880; Annelids of Provincetown, Rept. U. S. F. C. 1884, p. 721. Annelids from Bermuda, Bull. U. S. Nat. Mus. 1884, p. 321. Andrews, Annelida Polychæta of Beaufort, Proc. U. S. Nat. Mus., vol. 14, p. 288, 1891.

Collected from Puerto Real and Arroyo. The specimen from Arroyo had a transverse row of brown spots across each segment of the posterior end of body.

NICIDION Kinberg.

Nicidion brevis Ehlers.

Nicidion brevis Ehlers, Annelids of the Blake, p. 98, pl. 28, figs. 9-14; pl. 29, figs. 1 and 2.

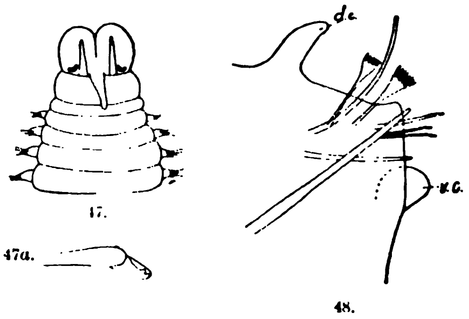
Collected from station 6085, Mayaguez, Puerto Real, Caballo Blanco reefs, and Ensenada Honda, Culebra.

LYSIDICE Sav.

Lysidice sulcata, n. sp.[1]

Head deeply bilobed (fig. 47). (*L. notata* Ehlers, Annelids of Blake, p. 100, to which it seems to be closely related, shows no trace of this lobing.) Tentacles three, middle one the longest. Eyes dark brown, just outside of outer antennæ. Roughly crescent-shaped, posterior end of crescent the larger. Peristomium about four times wider than long. Second segment about half as long as buccal and slightly wider. Successive segments widening gradually to the sixth, which is as wide as greatest width of body. Parapodia first appear on third segment. Anterior parapodium uniramous, with dorsal capillary and ventral jointed setæ. The terminal joint short and toothed (fig. 47*a*). A single aciculum. Posterior parapodia with two aciculæ and comb-shaped setæ (fig. 48). In other respects like anterior ones.

The specimen was incomplete, having lost the posterior end; 102 segments present. At the head the animal was 2 mm. in diameter; length 23 mm.



FIGS. 47, 47*a*, 48.—*Lysidice sulcata*. Fig. 47, Head, × 12. Fig. 47*a*, Ventral seta, × 163. Fig. 48, Posterior parapodium, × 46.

This differs from *L. notata* in the cleft condition of the cephalic lobe and in the presence of comb-shaped setæ on posterior parapodia. Anterior end deep reddish brown (in formalin). Cephalic lobe and tentacles very light brown.

Collected from reefs at Ponce and stations 6065 and 6079.

Family GLYCERIDÆ.

GLYCERA Sav.

Glycera abranchiata, n. sp.

Head of usual form, narrow, not noticeably segmented, about one-third as long as extended proboscis. Four delicate tentacles. Proboscis smooth at base, but for greater part of its course covered with minute papillæ; at end, with a row of much larger papillæ. Four strong, black teeth. Segments biannulate, increasing gradually in width up to about the twenty-fifth, which is five times broader than long. From here the body gradually decreases in width, that of posterior segments equaling their length. Two anal cirri. The parapodium of the twenty-fifth segment is equal in length to about one-fifth of the diameter of the body. Those of the posterior end of the body equal in length to whole width of body. The anterior end of body cream color, posterior end much thinner and transparent. Parapodium of first segment very small, others increasing in length up to the twenty-seventh. Each (fig. 49) with two rounded posterior, and two much longer, pointed, anterior, lips. The ventral cirrus is broad with an acute apex; dorsal cirrus small, rounded, situated on the body wall. A dorsal and a ventral aciculum.

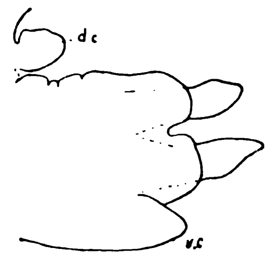


FIG. 49.—Parapodium of *Glycera abranchiata*. *d. c.* and *v. c.*, dorsal and ventral cirri.

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[1] Since the manuscript for this paper was sent to the printer, I have received from Professor Verrill his paper on Additions to the Turbellaria, Nemertinea, and Annelida of the Bermudas, Trans. Conn. Acad. Sci., vol. x, pt. 2, Nov., 1900. This paper is not accompanied by figures, but from the descriptions I am inclined to believe that this species may possibly be identical with Verrill's *Lysidice bilobata*.

Setæ of two kinds. Dorsal ones simple, long, smooth, curving gradually to an acute point. Ventral ones compound, the terminal articulations long, tapering, slightly curved, with minute denticulations on their concave edge. There are no gills.

Collected from Arroyo.

Glycera tesselata Grube.

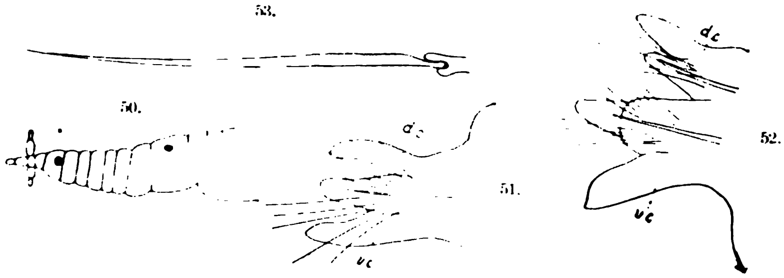
Glycera tesselata Grube, Archiv. f. Naturgesch. Jhrg. 29, 1863. Quoted from Ehlers, Die Borstenwürmer, p. 655, pl. 24, figs. 2, 9, 33, and 34.

Collected from stations 6055, 6066, Ensenada Honda (Culebra), Puerto Real.

GONIADA Aud. et Milne-Ed.

Goniada oculata, n. sp.

Head of ten segments. A pair of eyes in first and in anterior portion of eighth. Tenth segment carrying four tentacles. (Fig. 50.) Basal joint of tentacle longer than tenth segment and nearly as great in diameter. Terminal joint of tentacle small, rounded. Length of 60 segments, 15 mm.; width, 1 mm. Anterior parapodia uniramous, with rounded-flat dorsal and ventral cirri. Dorsal cirrus a little shorter than the parapodium; ventral cirrus somewhat longer (fig. 51). At about the thirty-sixth segment the dorsal ramus appears (fig. 52). This is small, with a very few stout setæ. Setæ of ventral ramus compound (fig. 53, of a lateral seta). Terminal joint of medium ones much shorter than those of the lateral. Color, light brown. On ventral surface a red spot in center of each segment.



FIGS. 50–53.—*Goniada oculata*. Fig. 50, Head, ×26. Fig. 51, Parapodium, ×100. Fig. 52, Posterior parapodium, ×87. Fig. 53, Seta, ×163.

This seems closely related to *G. gracilis* (Webster, Annelids of Provincetown, U. S. F. C. Rept. 1881, p. 723. *Eone gracilis* Verrill, Invert. of Vineyard Sound, p. 596), but differs in having antennæ with two instead of three articles, in greater number of segments in the head, and in the larger size of the eyes.

Collected from station 6064.

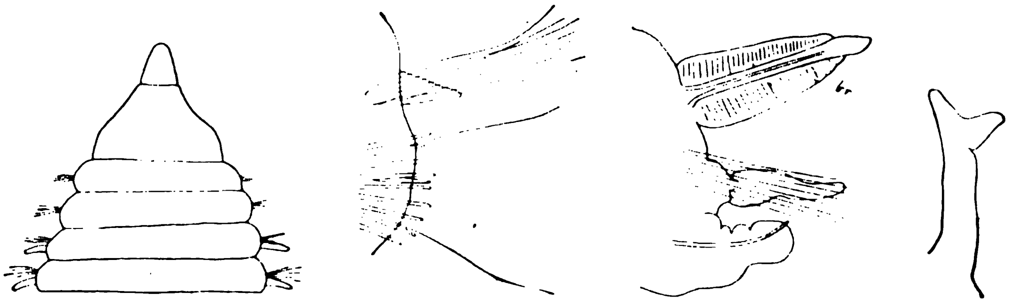
Family ARICIIDÆ.

ARICIA Sav.

Aricia cirrata, n. sp.

Head acute, without eyes (fig. 54). Buccal segment as long as first two segments. Body narrow anteriorly, rapidly widening so that posterior end is nearly four times breadth of anterior. Flat dorsally, rounded ventrally. Dorsal portion of first sixteen segments with very broad space between parapodia of the two sides. At about the sixteenth segment this space becomes very much narrower.

Anterior parapodia small, with dorsal bundle of long, delicate, toothed setæ and a ventral vertical row of very stout, brown, slightly curved setæ. A few capillary, like the dorsal setæ, are found among these (fig. 55). Farther back this ventral row is replaced by a prominent, cylindrical, ventral ramus (fig. 56). In one specimen this change occurred on the seventeenth, in another on the fourteenth, and in another on the twentieth setigerous segment. Both rami carry long, delicate, capillary setæ, though they may be absent from the ventral ramus. I believe that they are normally present, but easily break away. Farther back the setæ in each ramus become very much stouter, not so long, have a brown color and smooth edges. Dorsal cirri appear first on third setigerous segment, at first rather short and cylindrical, increasing rapidly in length to about segment 16. A curious abnormality is the bifid or trifid end of many of these cirri on the specimen from station 139 (fig. 57). Branchia appear first in one specimen on sixteenth setigerous segment; in another on twelfth setigerous segment; they are small at first, gradually increasing in size up to the twelfth, which is full size; very prominent, flat, with acute tips (fig. 56, *br.*).



54. 55. 56. 57.

FIGS. 54–57.—*Aricia cirrata*. Fig. 54, Head, × 12. Fig. 55, Anterior parapodium, × 23. Fig. 56, Posterior parapodium, × 26; *br.*, branchia. Fig. 57, Bifid dorsal cirrus from one specimen of *A. cirrata*, × 40.

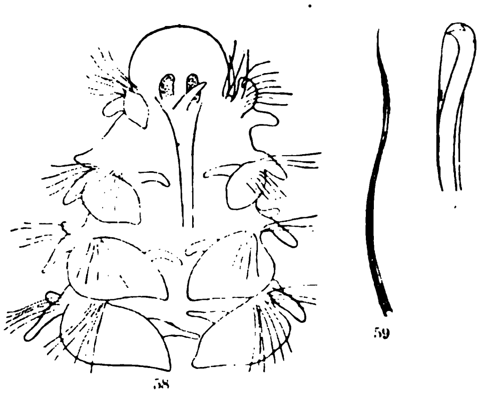
Color in places bright reddish brown; elsewhere, yellowish brown.

Specimens incomplete. One of 75 segments; length, 50 mm.; width, 3 mm.; at narrowest point, 2.5 mm. Collected from stations 6061, 6066, and 6067.

ARICIDEA Webster.

Aricidea alata, n. sp.

Head rounded, smooth; two very large, irregularly shaped eyes. Median tentacle straight, conical, reaching to anterior border of eye. First segment with parapodium. On the second the broad, flat, dorsal cirrus ("second gill") becomes prominent, and from the third on these are very large, covering a large part of the back (fig. 58). They do not lie flat on the dorsal surface, but are elevated a little above it. Beginning with the second and ending with the thirty-first, the long, conical, dorsal gills arise from the dorsal edge just to the median edge of the dorsal cirrus. The latter spread out like broad wings on either side of the segment. In front of each is a row of stout, golden yellow setæ (fig. 58). These are curved, tapering gradually to a sharp apex, and marked by longitudinal striations (fig. 59). Ventral ramus with broad, flat posterior lip ("third gill"), with setæ like dorsal. Toward posterior end both second and third gills become much less prominent, and the setæ are fewer in number. Large hooked setæ appear in the ventral ramus (fig. 60). Throughout greater part of body a delicate longitudinal band of tissue runs along the side, uniting the parapodia of successive fragments. Color white.



58 59

FIGS. 58–60.—*Aricidea alata*. Fig. 58, Anterior end, × 28. Fig. 59, Capillary seta from anterior segment, × 121. Fig. 60, Uncinate seta from posterior segment, × 143.

A single incomplete specimen of 54 segments. Length, 24 mm.; breadth, 1 mm.; from Arroyo.

ANTHOSTOMA Schmarda.

Anthostoma ramosum Schmarda.

Anthostoma ramosum Schmarda. Neue Wirbellose Thiere. p. 62. Webster. Annelids from Bermuda. p. 321.

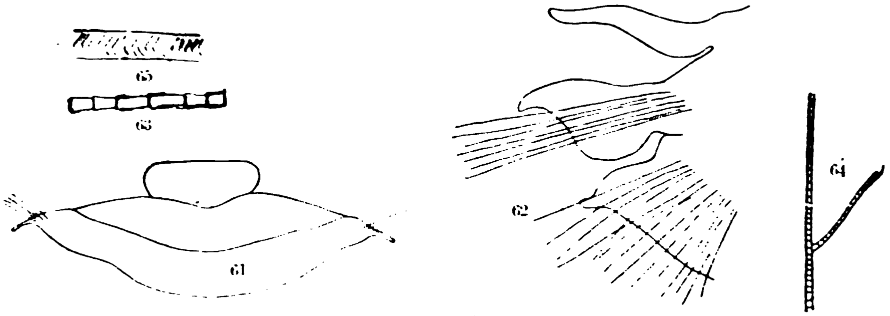
So far as I can tell from Schmarda's brief description, these belong to his species. Head rounded, almost semicircular in form. Proboscis in form of three broad plates, one much larger than the other two. Each much subdivided, colorless at base, dark-brown at apex. Body very much flattened and broad back to segment 34, with very short gills, leaving more than half the dorsal surface exposed. At about thirty-fourth segment it becomes narrower, looking as if dorsal surface of parapodium had rolled upward, and the gills elongate so as to cover whole of dorsal surface. The gills begin on the fourth setigerous segment.

If I have correctly identified this specimen, Schmarda's description and figure of the parapodium applies only to the posterior segments, and here the dorsal gill is relatively too small in his figure. Anteriorly the parapodia contain from 9 to 13 stout setæ. Only at the posterior end is the number as low as 4, as Schmarda has described.

Collected from Arroyo and Boqueron Bay.

Anthostoma latacapitata, n. sp.

Head nearly four times broader than long, anterior edge nearly straight, angles rounded. No eyes. (Fig. 61). First segment twice as wide as head, second segment (first setigerous) a little wider than first, and succeeding segments of equal width with this, back to segment 25. Here the body narrows very slightly and remains of a uniform width throughout. Setigerous segments as far as twenty-third (fig. 62), with a broad dorsal cirrus ("second gill") and dorsal bundle of long, delicate setæ, each with numerous fine parallel transverse markings (fig. 63). A single one of these was bifurcated at end (fig. 64). On ventral ramus a prominent posterior lip, its dorsal angle prolonged into a conical point (fig. 62). This lip is marked off posteriorly by a short constriction from the parapodium. Ventral setæ very numerous, forming a dense comb-shaped row. Setæ stout, narrowing rapidly to an acute point, which may be bent, or completely curved on itself, the stem marked with numerous transverse lines (fig. 65). In figure of parapodium only a few of these are represented.



FIGS. 61-65.—*Anthostoma latacapitata.* Fig. 61. Anterior end, × 18. Fig. 62. Parapodium, × 18. Fig. 63, Dorsal seta, × 330. Fig. 64. Bifurcated seta, × 520 Fig. 65. Ventral seta, × 390.

Dorsal gills begin on sixth segment. They are linear, with acute apex. Behind twenty-third segment the ventral row of setæ becomes much shorter, and throughout the greater part of the body the posterior lip of ventral ramus is ovate with acute tip. Anterior lip more prominent than anteriorly. Setæ of ventral ramus of two kinds. A few (two) blunt, rounded, hardly reaching beyond apex of anterior lip, and ten to twelve delicate, long, finely toothed, with transverse lines like those of anterior dorsal setæ. Dorsal cirrus shaped like anterior ones, but much smaller, and dorsal gill proportionately much larger than anteriorly. Very thick at base, tapering rapidly to apex, and extending for one-quarter of its length beyond dorsal cirrus. In the preserved specimen these dorsal gills are bent backward and slightly outward, leaving dorsal surface of body uncovered. Proboscis only slightly protruded, edges of protruded portion ramose.

Color, light brown to gray, with darker spots dorsally. A large dark spot in front of dorsal gill on either side.

The collection contained 3 fragments from Hucares. Two, apparently from the same specimen, were 50 and 44 mm. in length. Posterior end not preserved. Greatest breadth 4 mm.

Family CIRRATULIDÆ.

CIRRATULUS Lam.

Cirratulus melacanthus Grube.

Cirratulus melacanthus Grube, Die Familie der Cirratuliden; Bericht über die Thätigkeit der Naturw. Sect. der schlesischen Gesellschaft im Jahre 1872, p. 31. Quoted from Ehlers, Annelids of the Blake, p. 155.

Head segment too badly mutilated for identification. I have identified the specimen from the structure of the parapodium. Collected from Guanica Bay.

Cirratulus nigromaculata, n. sp.

Body short, 10 mm. in length, rather less than 2 mm. broad in widest portion; tapering gradually toward either end, anterior end much more blunt than posterior. Head rather thick, rounded, much narrower than segments immediately behind it (fig. 66). Segments very short, their limits difficult to make out in contracted alcoholic material. Setæ in two bundles, the dorsal rather longer than ventral, all very delicate, capillary, and difficult to see. From the fifth or sixth, or possibly both, the dorsal gills arise on either side (fig. 66). These are long and thick, nearly half the length of body. There are at least four on a side, more or less united at their bases (only three shown in the figure). At intervals along the back appear the much more delicate lateral gills. These break away so easily that it is impossible to say how many are normally present. In one of the two specimens in this collection there are five, the last arising three-fourths of the distance from head to tail.

Color, ventrally white, with a decided brownish tinge dorsally. Whole body spotted with irregular black marks, especially numerous along the mid-dorsal line. The dorsal gills are white, with numerous black bands (fig. 66). The lateral gills are covered with minute brown spots, except for a colorless band near the apex. Extreme tip of gill brown.

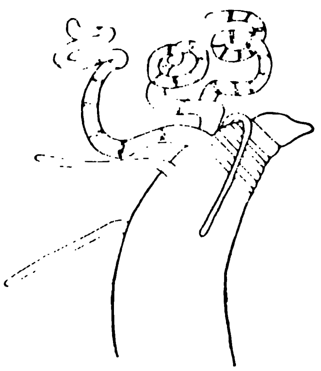


FIG. 66.—Anterior portion of *Cirratulus nigromaculata*, × 5.

Collected from Ensenada Honda, Culebra.

Cirratulus elongatus, n. sp.

Head short, conical (fig. 67). The three following segments smooth, rather long, limits between them not sharply marked off; without appendages. Setæ begin on fourth segment; from here segments increase rapidly in width up to tenth, and from there decrease in width for a short distance, then remaining of uniform breadth to posterior end. No eyes. Lateral gills as long delicate cirri, easily broken away; only a very few remained attached in the single specimen at my disposal. After about the fiftieth segment the body becomes very thin-walled, and is much coiled. Setæ in two rows, long, delicate, capillary (fig. 67). Color, yellowish brown. Gills a darker brown. Length 60 mm. Breadth at widest portion, 2 mm.; at narrowest, 1 mm.

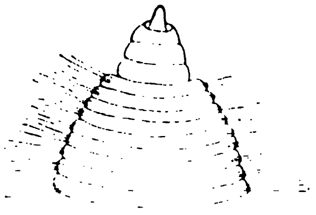
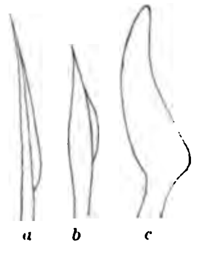


FIG. 67.—Anterior end of *Cirratulus elongatus*, × 23.



FIGS. 68, *a*, *b*, *c*.—Setæ from *Phyllochætopterus claperedii*, × 143.

From the structure of the gills and arrangement of the setæ, I have included this specimen provisionally in this genus. Too many of the gills had been lost to make the identification positive.

Collected from Ensenada Honda, Culebra.

Family CHÆTOPTERIDÆ.

PHYLLOCHÆTOPTERUS Grube.

Phyllochætopterus claperedii (?) McIntosh.

Phyllochætopterus claperedii McIntosh, Challenger Reports, vol. XII, p. 374; pl. 45, figs. 9, 10, 10*a*, 11; pl. 46, fig. 1; pl. 24*a*, figs. 1–5.

Tubes of this genus were included in this collection, and a few of these contained fragments of the animals. A single specimen retained enough of the anterior segments for comparison with McIntosh's description of this species, and the points of agreement were so many that I have placed them here, though it is not impossible that specific differences would be found if complete specimens were available for comparison. Figs. 68*a*, 68*b*, 68*c* show characteristic setæ, fig. 68*a* showing the dorsal, and fig. 68*c* the ventral one, fig. 68*b* being intermediate in position between the other two. The "tooth-like" brown spines were also present.

Collected from stations 6055 and 6075.

Family TEREBELLIDÆ.

TEREBELLA Malmgren.

Terebella annulifilis Grube.

Terebella annulifilis Grube, Jahresbericht der Schles. Gesellsch. Natur., sect. fur 1871, p. 49. Quoted from Grube, Annulata Semperiana, p. 225, pl. 13, fig. 2, 1878.

Collected from Ensenada Honda, Culebra; Arroyo; Ponce; Mayaguez.

Terebella variegata Grube.

Terebella variegata Grube, Monatsb. d. Berl. Akad., 1869. Quoted from Grube, Ann. Semp. p. 227, pl. 13, fig. 3, 1878.

The original description of this species was inaccessible to me. It apparently conforms to the diagnosis given by Grube, loc. cit., second reference. Collected from Guanica Bay and reef at Ponce.

Terebella turgidula Ehlers.

Terebella turgidula Ehlers, Annelids of the Blake, p. 241, pl. 52, figs. 1–8.

According to Ehlers, this differs from the generic description in having 18 bunches of capillary setæ. All of the Porto Rico specimens, which agree very closely in other respects with his description, have 17. Gills with very thick stem, branches very arborescent; anterior gill largest, the next three-fourths size of first, the third very small. In Ehlers's type specimen the third left gill was not present. In a specimen from Playa de Ponce the first right gill had been lost, not even a scar showing the point of attachment remaining. It either had not developed or had broken away so long before the animal was killed that the wound had entirely healed. I would suggest that the loss of the third gill in Ehlers's type specimen is a similar individual variation.

Collected from Playa de Ponce and from Ensenada Honda, Culebra.

Terebella sp.

From Mayaguez Harbor was collected the posterior portion of a Terebellid, which, on account of the loss of the head, could not be identified. Posterior segments thin-walled, much swollen. Color in formalin, a dark purplish brown.

PHENACIA Grube.

Phenacia robusta Grube.

Phenacia robusta Grube, Annulata Semperiana, p. 235, pl. 12, fig. 8.

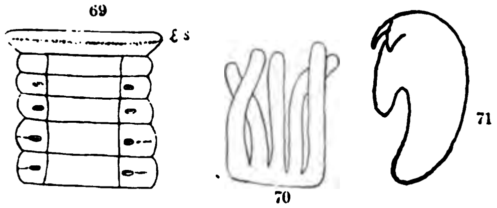
Grube's description says that only a very narrow space separates the gill filaments of the two sides. His figure, however, shows a considerable space between the *bases* of these filaments. The Porto Rico specimens agree in this respect more closely with his figure than with his description. Shell covered with numerous flat calcareous plates. Bryozoa skeletons.

Collected from Puerto Real; station 6065, Boqueron Bay. From another bottle the locality label was lost in transferring.

THELEPUS Malmgren.

Thelepus crassibranchiatus, n. sp.

Head not especially prominent, with row of very numerous eye-spots just under the lobe of its disk (fig. 69). Tentacles very thick, about as long as first ten body segments. Four on a side. Branchiæ in two transverse rows on second and third segments (counting the head as first). Those of second segment five straight thick filaments in a transverse row on either side, more or less fused at their bases (fig. 70). Branchiæ of third segment similar to those of second, but each composed of only three filaments on a side, filaments more delicate and not more than three-fourths as long as anterior gills. Capillary setæ begin on third, uncinate on fifth segment. Posterior portion of body broken, but apparently both kinds of setæ are present on all segments. Uncinate setæ with one strong terminal tooth and two laterally placed smaller teeth (fig. 71). On the thorax each segment is marked with parallel lines, forming a rectangular plate (fig. 69).



FIGS. 69–71.—*Thelepus crassibranchiatus.* **Fig. 69.** Anterior portion, × 20; *e. s.*, eye spots. **Fig. 70, Branchia of second segment,** × 13. **Fig. 71, Uncinate seta,** × 428.

Family AMPHARETIDÆ.

AMPHICTEIS Grube.

Amphicteis nasuta Ehlers.

Amphicteis nasuta Ehlers, Annelids of the Blake, p.232, pl. 49, figs. 1 6. (Ehlers's plate is labeled "Ampharete." From the context, this is evidently a misprint.)

A single specimen, labeled "Sta. 6055, Aguadilla," evidently of this species, though the characteristic paleæ of the second segment had been lost. Only the 14 anterior segments were preserved.

Family AMPHICTENIDÆ.

PECTINARIA Lam.

Pectinaria gouldii Verrill.

Cistenides gouldii Verrill, Invert. of Vineyard Sound, p. 612, pl. 17, figs. 87, 87*a*.
Pectinaria belgica Gould, Invert. of Mass., 1841, p. 7.
P. auricoma (Grube) Leidy, Invert. Fauna of Coasts of R. I. and N. J., 1855.
P. grœnlandica (Grube) Stimpson, Marine Invert. Fauna of Grand Manan, Smithsonian Contributions, vol. 6, 1854.
Cistenides gouldii Webster, Annelida Chætopoda from Provincetown.
Pectinaria gouldii Verrill, New England Annelida, pt. 1, p. 287, U. S. F. C. Rept. for 1880, p. 731. Andrews, Annelids from Beaufort, N. C., p. 297.

These are larger than the specimens described by Verrill, reaching a length of 64 mm. From Ensenada Honda, Culebra, and station 6055.

Family CAPITELLIDÆ.

DASYBRANCHUS Grube.

Dasybranchus umbrinus Grube.

Dasybranchus umbrinus Grube, Annulata Semperiana, p. 189.

Collected from stations 6061, 6062, 6066, and Boqueron Bay.

Dasybranchus lunulatus Ehlers.

Dasybranchus lunulatus Ehlers, Annelids of the Blake, p. 174, pl. 45, figs. 5 to 9.

Collected from Puerto Real and Arroyo.

With these I have included, rather doubtfully, two small specimens from station 6061 and one from station 6055, which seem to me to be probably the young of this species. They differ from Ehlers' diagnosis in that 16 segments bear capillary setæ, the last three, however, being very delicate.

Dasybranchus rectus, n. sp.

Anterior portion of 13 segments, the first entire; the second biannulated below, the rest distinctly biannulated above and below (fig. 72). Cephalic lobe triangular (not shown in figure), with blunt point, and on either side a dark patch composed, as seen under high power, of a great many irregularly shaped pigment spots. (Eyes.) Second segment about six times broader than long. Beginning with the second and extending to and including the thirteenth, each segment has four bundles of setæ. Seta bundle very short, white, arising from the groove which divides the segment into annuli, and with a dark pigment patch at base. Setæ extremely delicate, needle-shaped. Anterior segments increase in size up to the fifth and then slowly decrease in diameter to the fourteenth. Dorsal surface of first five segments divided by anastomosing lines into numerous small, hexagonal or pentagonal areas. Pharynx thin-walled, with numerous delicate papillæ. Second portion of body slightly wider than segments 11-13 (fig. 72). Tori rather prominent, meeting ventrally, but with a considerable space between their dorsal ends. Dorsal wall of segment between tori rather thin and protruding. This becomes more noticeable farther back, where the whole wall is very transparent and thin, and the intestinal contents are easily seen through it. Anterior portion of body is much straighter than in other species, and there are not so great differences in the diameter of different segments. Uncini awl-shaped, slightly curved at end and sharp. Not toothed.

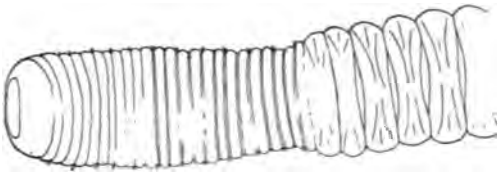


FIG. 72.—Anterior portion of *Dasybranchus rectus*. × 4.

Collected from stations 6055, 6061, and Ensenada Honda, Culebra.

Family OPHELIIDÆ.

AMMOTRYPANE Rathke.

Ammotrypane fimbriata Verrill.

Ammotrypane fimbriata Verrill, Invertebrates of Vineyard Sound, p. 604, pl. 15, fig. 79.

The eyes described by Verrill were not to be seen in these specimens, but in other respects they agreed with his description. Collected from Ensenada Honda, Culebra, and from stations 6093, 6092, 6096, and 6098.

Family MALDANIDÆ.

CLYMENELLA Verrill.

Clymenella torquata Verrill.

Clymene torquatus Leidy, Marine Invert. Fauna of R. I. and N. J., p. 14; Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 3, p. 146.
Clymenella torquata Verrill, Invert. of Vineyard Sound, p. 608, pl. 14, figs. 71-73. Webster, Annel. Chæt. Virginia Coast, p. 28. Annelida Chæt. Provincetown, U. S. F. C. Rept. 1881, p. 731. Andrews, Annelida Polychæta of Beaufort, p. 294.

An incomplete specimen, lacking the anterior end, from Playa de Ponce Reef, and an anal funnel from station 6055.

CLYMENE Sav.

Clymene cirrata Ehlers.

Clymene cirrata Ehlers, Annelids of the Blake, p. 182, pl. 46, figs. 10 to 13.

Four incomplete specimens, all with the posterior ends lost, were collected from station 6055

Clymene cingulata Ehlers.

Clymene cingulata Ehlers, Annelids of the Blake, p. 85, pl. 47, figs. 2 to 5.

Collected from station 6069. Another from station 6068, marked "water haul, dredge fouled," very poorly preserved and lacking both head and tail segments, is probably of this species.

Two small specimens, marked "Aguadilla, 6055," agree with the above in the shape of the head, but lack the collar on the fourth segment, and the teeth of the uncinate setæ are much less developed. From their small size I have considered them immature specimens of *C. cingulata*.

Clymene sp.

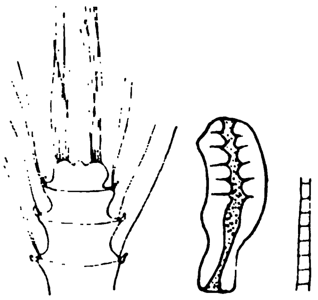
Fragments of a specimen of this genus, of a different species from the above, but too much injured for identification, were collected from Ensenada Honda, Culebra.

Family CHLORÆMIDÆ.

STYLAROIDES Claparède.

Stylaroides glabra, n. sp.

A single specimen, to which I have given the above specific name, was collected at station 6066. The head had been more or less mutilated. An outline drawing of its present appearance is given in fig. 73. The proboscis had been broken away before the drawing could be made, and is drawn to twice the same scale as the rest in fig. 74. It is thick, with sides much wrinkled and folded over. Setæ of first three segments long, reaching beyond head. Apparently a greater number of setæ on first than on succeeding segments, but so many of the latter were broken that this is difficult to determine. On second and succeeding segments dorsal and ventral setæ bundles are separated by a considerable space. Dorsal setæ much smaller than ventral. All setæ marked with transverse lines. (See fig. 75.) Body covered, except toward the posterior end, with a thin, transparent shell, in which are embedded numerous fine grains of sand. Anteriorly the surface of body is smooth, light brown in color. Posteriorly the portion not covered by the shell is rougher and marked by brownish lines, but no papillæ. Dorsal cirrus of anterior parapodia short, acute; of posterior ones, long, club-shaped.


73. 74. 75.

FIGS. 73-75. *Stylaroides glabra.*—**Fig. 73,** Anterior portion, 12. **Fig. 74,** Proboscis. Fig. 75, Seta very highly magnified.

Length, 28 mm. Width in widest part, 2 mm, tapering slightly toward head and tail.

SIPHONOSTOMUM Otto.

Siphonostomum cariboum Grube.

Siphonostomum cariboum Grube, Annulata Oerstediana, 1858, p. 108. Quoted from Ehlers, Annelids of the Blake, p. 158, pl. 42, figs. 6-9.

Collected from Ensenada Honda (Culebra), and from stations 6062 and 6063.

Family SABELLIDÆ.

SABELLA (L.) Malmgren.

Sabella spectabilis Grube.

Sabella spectabilis Grube, Annulata Semperiana, p. 253, pl. 14, fig. 4.

In the main features of size, structure, and color, these agree with Grube's description. Minor differences are these: Grube says that the first shield has an incision on its anterior edge, that the capillary setæ are shorter toward posterior end, and that gill filaments are present as far as the extreme end of the gill. Grube gives no figures of the tip of the gills, and I am not certain from his description whether in the last point his specimens really differ from those I have. In the other features they do not agree. The tentacles are relatively longer, also, than in Grube's specimens. Since, however, they agree in other respects, I have assigned them to Grube's species. Tube of parchment-like material, the upper end covered with fine mud.

Collected from Ponce, Boqueron Bay, reef at Ponce, Mayaguez, Guanica Bay, and Hucares.

Sabella melanostigma Schmarda.

Sabella melanostigma Schmarda, Neue Wirbellose Thiere, p. 36, pl. 32, fig. 190; Ehlers, Annelids of the Blake, p. 263.

Specimens of this species very numerous in this collection. The thoracic segments number from 12 to 15. Ehlers says there are always 15. This variation does not seem to be due to age differences, as the largest do not always have the most segments. Two to five pairs of eyes on tentacles.

Collected from Ponce, Guanica Bay, reef at Ponce, Boqueron Bay, and Ensenada Honda, Culebra. A tube from station 6051.

PROTULIDES Webster.

Protulides elegans Webster.

Protulides elegans Webster, Annelida from Bermuda, p. 325; Andrews, Annelida from Beaufort, p. 299.

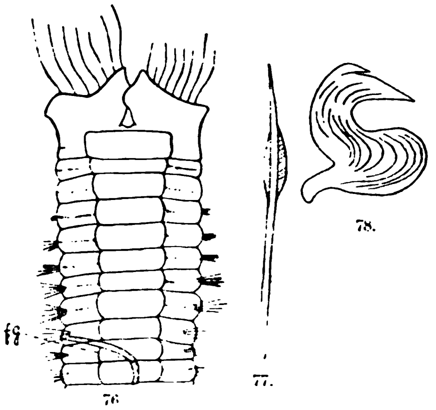
These agree with Webster's description in every respect except color. The basal portion of the branchiæ is purple to beyond their uniting membrane. The dorsal surface of each filament is light purple. An occasional pinna deep purple. About 25 eye-spots on either side of each filament, extending over half of their free extremity. General body color light brown. A ventral dark band, about one-fourth of the whole width of body, extends from extreme posterior end to about the fifth or sixth thoracic segment.

From Guanica Bay, Ensenada Honda (Culebra), Mayaguez, station 6085, reef at Ponce, Caballo Blanco Reef.

DASYCHONE Sars.

Dasychone ponce, n. sp.

This is apparently closely related to *D. conspersa* (Ehlers, Annelids of the Blake, p. 266, pl. 54, figs. 1–6), but differs from it in the greater number of branchiæ, the lack of regularity in shape and distribution of color spots, and in absence of a ventral compressed area. Gills very much coiled, the most ventrally placed filament very short, scarcely 1 mm. long; following filaments increase gradually in length up to the tenth, which is as long as the rest of the filaments, approximately 13 mm. long; 42 filaments on a side. Inclosed by the branchiæ are the two tentacles, about 5 mm. long. Branchiæ united by a basal membrane for 2 mm. of their length. Basal portion of branchia where united by the membrane, brown; membrane itself, white. Free portion of branchia white, crossed by dark bands; 13 to 15 eye-spots on each filament; a variable number of dorsal appendices on each filament. Some individuals have two pairs of these dorsal appendices much larger than the rest. This does not appear in all specimens. Terminal portion of filament smooth. Collar with two triangular lobes projecting anteriorly on ventral surface (fig. 76). Inner surface of these lobes marked with irregular blotches of brown. The general color of collar brown, with white border. Collar incomplete dorsally, ending by rounded lobe just above dorsal seta bundle. Body rounded dorsally, flattened ventrally. General color light brown, with numerous irregularly arranged dark-brown blotches. A dark-brown patch along the ventral surface of the abdomen, in the center of which the light fæcal groove is prominent. (Fig. 76 *fg.*)



FIGS. 76–78. *Dasychone ponce*.—Fig. 76. Anterior portion, × 5; *fg.*, fæcal groove. Fig. 77. Capillary seta, × 50. Fig. 78. Uncinate seta, × 143.

Thorax with ventral shields (fig. 76). First the widest and narrowing gradually to third; from here, of uniform width backward. First segment with setæ placed far dorsally. Uncinate setæ appear first on second segment, where the row of these is longest, and gradually narrowing to eighth. Uncinate setæ become dorsally placed on ninth segment and continue to posterior end of body. A large irregularly shaped brown spot between the uncinate and the capillary setæ on each segment. Capillary setæ long, with expansion near end (fig. 77). Uncini stout, with large terminal and smaller dorsal tooth (fig. 78). Length of body, 30 mm. Width of thorax, 5 mm. Body nearly of uniform width throughout, tapering rapidly at posterior end. Tube very thin, delicate, paper-like in texture; color, light brown. At upper end covered with fine gray mud.

Collected from Ponce, Boqueron Bay, Arroyo, Playa de Ponce Reef, Mayaguez, reef near Ponce.

Family SERPULIDÆ.

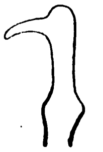
EUPOMATUS Phil.

Eupomatus parvus, n. sp.

In this species I have placed provisionally a few small specimens found on Bryozoa skeletons from Boqueron Bay and station 6062. It is not improbable that they are immature specimens of some species already described. They are very small. Length of body, 6 mm. Branchiæ, 2 mm. Operculum and stalk, 3 mm. Eight branchiæ on a side, with a rudimentary pseudoperculum opposite functional one. Branchiæ colorless, without pinnæ at tip. Stalk of operculum smooth. About 30 spines around edge of operculum. From upper surface of latter arise 8 long spines. These are enlarged at the base, curved and sharp at the end. At end each has sharp spines. (Figs. 79 from the side, 80 from rear.) Dorsal setæ of thorax like *E. uncinatus*. (Ehlers, Annelids of the Blake, p. 285.)

Both Ehlers and Schmarda (Neue Wirbellose Thiere, p. 29) describe in *Eupomatus* abdominal setæ with comb-shaped expanded ends. There are none of these in *E. parvus*. Abdominal setæ very long, acicular; 7 thoracic segments; about 45 abdominal segments. Tori of anterior segments long, of posterior ones shorter. Uncini like those of *E. uncinatus*.

This species differs from *E. uncinatus* in the structure of its operculum, in number of branchiæ (*E. uncinatus*, according to Ehlers, has 18 on a side), and in absence of comb-shaped abdominal setæ.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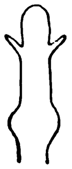
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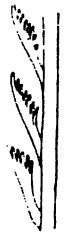
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FIG. 79.—Spine from operculum of *Eupomatus parvus*, seen from side, × 30.

FIG. 80.—Same, seen from rear, × 30.

FIG. 81.—Seta of *Hermella varians*, × 600.

VERMILIA (Lam.) Phil.

Vermilia annulata Schmarda.

Vermilia annulata Schmarda, Neue Wirbellose Thiere, p. 28, pl. 21, fig. 176. Ehlers, Annelids of the Blake, p. 308, pl. 58, figs. 12-16; pl. 59, figs. 1-3.

An empty shell; collected from station 6064.

POMATOSTEGUS Schm.

Pomatostegus stellatus Abildgaard.

Terebella stellatus Abildgaard, Schriften der Gesellschaft Naturforsch. Freunde zu Berlin. Bd. 9, 1789, p. 142.

Pomatostegus stellatus Mörch, Revisio critica a. a. o., p. 50.

Above references quoted from Ehlers, Annelids of the Blake, p. 296.

Ehlers says the operculum consists of four circular plates, while the end of the stalk which projects above the last plate bears a crown of little hook-shaped teeth. As Grube has pointed out (Annulata Semperiana, p. 272), each of these opercular plates is situated on a basal star-shaped plate, the attachment being so close that the basal piece is difficult to see. If, however, the terminal plate be pulled off, its stalk of attachment will show, on its end, this smaller star-shaped piece. The specimens from Porto Rico had one, three, and five of these plates on the operculum. Evidently the reduced number is due simply to the loss of plates originally present, and the star-shaped termination is merely the basal piece of a plate that has pulled off.

Collected from station 6076, Caballo Blanco Reef, Guanica Bay, Ensenada Honda (Culebra).

Family HERMELLIDÆ.

Hermella varians, n. sp.

Apparently very closely related to *H. bicornis* (Schmarda, Neue Wirbellose Thiere, p. 24, pl. 20, figs. 173*a*, 173, 173*b*), with which it agrees in the shape of the head, in the number and arrangement of the outer paleæ (about thirty on a side), in the possession of twelve lappets on either side, just below the circle of outer paleæ, and in the pair of jaw-like spines on the dorsal surface of the head. These spines are dark brown, stouter, and more jaw-like than in *H. bicornis*, and the inner paleæ are much less numerous, only four on a side. The outer paleæ are not toothed, but are broad flat plates showing longitudinal striations under high power. Paleæ of body segments with broad, flat end, with entire margin and end irregularly serrated. Setæ of ventral bundle of two kinds, one long, entire, very delicate, the other with toothed edges (fig. 81). Tentacles not very numerous; one on either side very much larger and longer than the rest. The specimen was badly preserved, only the head and a few anterior segments remaining. The color had all been lost (formalin) except a small purple brown spot on the ventral surface of one of the anterior segments.

Collected from station 6067.

DESCRIPTIONS OF TWO NEW LEECHES FROM PORTO RICO.

BY

J. PERCY MOORE,

Instructor in Zoology, University of Pennsylvania.

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The material under consideration was collected by the expedition sent with the steamer *Fish Hawk* to Porto Rico in the winter of 1898–99, under the auspices of the United States Fish Commission.

The leech fauna of the West India Islands is very imperfectly known and no fresh-water forms have hitherto been described from the island of Porto Rico. Consequently the two species composing this collection both prove to be novelties. One certainly has and probably both have a much wider distribution.

HIRUDINARIA Whitman (= PŒCILOBDELLA Blanchard ('93) subgenus).

Hirudinaria was established by Whitman ('86, p. 373) for the *Hirudo javanica* of Wahlberg, the generic characters assigned being the large size of the posterior sucker, together with the long interval (7½ rings) separating the male and female genital orifices. The great increase in our knowledge of the species of leeches, which we owe so largely to the labors of Blanchard during the last ten years, has rendered such characters, when taken alone, unavailable for generic distinctions. Accordingly Blanchard ('97) has discarded *Hirudinaria* and has referred the type species to his subgenus *Pœcilobdella* of the genus *Limnatis*. *Pœcilobdella* appears to stand for a very natural assemblage of forms typified by *Hirudo granulosa* Sav. and especially characterized by the very striking and constant color pattern, which is similar in all of the species included by its author. The described species have hitherto been known only from the tropical and subtropical East Indian islands and Indo-China. Blanchard has indeed mentioned, but without characterizing, a species from the island of Martinique.[1]

The leech described below under the name of *Hirudinaria blanchardi* may be the Martinique species. It has the typical color pattern of *Pœcilobdella* and resembles *Hirudinaria javanica* very closely in almost all important features of external organization, but the sex pores are separated by but five rings. I have dissected *H. blanchardi* and find, among other peculiarities of the reproductive organs (pl. 12, fig. 7), that the vagina and the common oviduct open separately into the female bursa (pl. 12, fig. 9). Professor Whitman has very generously placed at my disposal for dissection one of his specimens of *H. javanica*, in which the female organs, though less mature, present the same peculiarity.

The female organs of *Limnatis nilotica* (the type species) have been figured by Moquin-Tandon ('46) and Leuckart ('94). In this species the common oviduct opens into the vagina, the mouth of which, therefore, becomes the only internal opening into the bursa, as in *Hirudo*, etc. On the other hand, *L. nilotica* resembles *H. javanica* in the numerous small uniserial denticles and the papillæ which are found on the sides of the jaws. *Limnatis*, as understood by Blanchard, is naturally divided by the character of the female reproductive organs into two genera, the one typified by *L. nilotica*, the other by *H. javanica*. The latter is the *Pœcilobdella* group and will probably be found to include all of the species which have been referred to that subgenus; but for this genus the name *Hirudinaria* Whitman has priority.

A revised diagnosis of *Hirudinaria* based upon an examination of the type species and *H. blanchardi* is as follows: Resembling *Limnatis* in external annulation, lips, and jaws; the common oviduct and vagina have separate openings into a small bursa; the segmental sensillæ are large and usually elongated in shape; the denticles are small and very numerous; some of the pharyngeal glands open on conspicuous papillæ on the sides of the jaws. To this the color pattern as described by Blanchard for *Pœcilobdella* will probably need to be added.

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[1] From this island also three nominal species, referred to *Hirudo* and *Hæmopis* Moq.-Tan., were long ago described by Moquin-Tandon and Blainville. The habits of at least one of these suggest a *Limnatis* or *Hirudinaria*, but there is nothing in the descriptions of any of the three sufficient to identify it with the Porto Rican species.

Hirudinaria blanchardi, sp. nov.

Diagnosis.—Genital pores separated by five annuli, the male being situated at xi*b*5/6, the female at xii*b*5/6. Annulation as in *H. javanica* (Wahlberg) Whitman, except that xxiv*b*5 and *b*6 and xxv*b*1 and *b*2 are developed (that is, the annuli numbered 95 and 96 in Whitman's figure ('86, pl. xx, fig. 56) are in the present species each represented by two partially separated rings).

Named for Prof. Raphael Blanchard, of Paris.

External characters.—All of the examples are very much contracted. The type specimen, which is of medium size, measures as follows: Length, 39 mm.; greatest width (xviii or xix), 11 mm.; depth at same point, 5.6 mm.; diameter of mouth at base of upper lip, 2.5 mm.; diameter of sucker, 6 mm. The species reaches a much larger size, probably equaling our *Macrobdella decora.* The largest example is 64 mm. long and its greatest width is 18.5 mm., but most of those in this collection are much smaller, being from 15 mm. to 25 mm. long.

Owing chiefly to their contracted state the larger examples are short and thick, slightly depressed behind but becoming more and more terete toward the mouth. The greatest width occurs at the beginning of the posterior third, in which region the dorsal surface is much more convex than the ventral, as indicated in fig. 4, plate 12, by the greater distance *m dm* than *m vm*. A strong annular contraction occurs in all the smaller examples at about somites viii and ix, resulting in the appearance of a short rounded head united by a neck to the body, which is of a flattened, narrow, elliptical form. The lips and margins of the mouth are so much contracted that the folds which lie anterior to the jaws, and in some examples even the jaws themselves, are plainly visible. This would indicate that under normal conditions the mouth is of large size, as in *H. javanica.* No distinct clitellum is indicated.

There are 104 annuli, beginning with the prostomium and ending with the postanal annulus at the base of the acetabulum (pl. 12, figs. 2 and 3). Owing to contraction they become very short and crowded at the posterior end, but much less so anteriorly. The annuli are marked off into quadrate areas, each of which contains one or more pointed papillæ and very numerous smaller sense organs (pl. 12, fig. 4). The larger papillæ become very prominent posteriorly and at the margins of the body. Some further details are added below in connection with a description of the annulation and metameric sensillæ.

The broad upper lip consists of the preocular region, here counted as one somite and one annulus, together with the first three eye-bearing annuli and the fifth annulus (pl. 12, figs. 1 and 2). Like the remainder of the body, this region is roughened by numerous non-segmental papillæ. A deep longitudinal median sulcus (pl. 12, fig. 1) divides the lower surface of the lip, as in *Limnatis*, into equal halves. Posteriorly this sulcus widens into a triangular depressed area from which the median jaw rises. On each half of the lip are about three less deep sulci about equidistant and extending parallel to the median one. Between these the lip is nearly smooth, but is studded with numerous minute sense organs, which are especially plentiful near the anterior margin. The mouth is bounded posteriorly by the coalesced sixth and seventh annuli (pl. 12, fig. 1).

A full somite separates the sex pores, the male being situated at xi*b*5/6, the female between the corresponding annuli of xii. Both of these orifices are inconspicuous and not indicated by any elevations, glandular areas, or pits. The male pore is somewhat the larger, but in no case does the penis protrude. No clitellum is visible even on the largest specimens. Nephridiopores are found in the position and number usual in the family (pl. 12, fig. 4, *np.*). They are placed exactly on the inner margin of the ventral black band.

The posterior sucker (pl. 12, fig. 3), like the posterior region generally, is much contracted, but still large. Its anterior margin reaches as far forward as somite xxiii, so that when relaxed it would probably have the size and proportions of the corresponding part in *H. javanica.* Dorsally it is marked by six or eight irregular transverse wrinkles, and is somewhat roughened and bears papillæ, as in the body annuli. Numerous elongated sensillæ are also found here, but they vary much in number, size, and position in different individuals. Ventrally, the sucker in its contracted state is more or less funnel-form, with a deep central depression and sloping sides which are marked by numerous faint radiating furrows. The anus is of small size and is situated between somite xxvii and the base of the sucker.

Annulation.—In the following description of the annulation, the annulus bearing the metameric sensillæ is regarded as the middle one of the complete somite (see Castle, 1900, and Moore, 1900). The description further serves to show how this view works out when applied to one of the five-ringed *Hirudinidæ*. This leech possesses fifteen typical complete somites, being Nos. IX to XXIII, inclusive (pl. 12, figs. 1, 2, and 3). The five rings constituting each are of approximately equal length, but, as indicated by the symbols on figures 2 and 3, they have very different morphological values, the middle annulus being equal to the first plus the second, and to the fourth plus the fifth. (See Moore, '98 and 1900.)

The structural details of the exterior of the complete somite XV are shown in figure 4, plate 12, the portion included between the lines *dm* and *m* representing the dorsal surface and between *vm* and *m* the ventral surface. Owing probably in part to the accidents of contraction, the annuli are of irregular length; they overlap somewhat at the posterior margin, and are in places marked by slight wrinkles, usually running transversely. More definite and constant longitudinal furrows, which tend to alternate in position on adjacent annuli, divide the surface into quadrate areas. According to their size, these areas bear one, two, or more of the conical sense organs each elevated on a papilla and surrounded by a group of small goblet-shaped organs and sometimes by smaller conical organs. When not too much displaced by contraction, these papillæ form a range along the middle of each annulus. They vary much in size in different places and individuals, but are especially rough and prominent at the margins and posterior end of the body.

The middle annulus, in addition to these non-metameric organs, bears seven pairs of very conspicuous metameric sensillæ which have the large size, the shape, and inclined position so well represented in Whitman's ('86) figure of *H. javanica*. Typically four pairs of these are dorsal (pl. 12, fig. 4), the dorso-median (*md*), the dorso-lateral (*dl*), the dorso-marginal (*dma*), and the supramarginal (*sm*); three pairs are ventral, the submarginal (*sbm*), the ventro-marginal (*vma*), and the ventro-lateral (*vl*). They are of elliptical outline with a rather prominent axial ridge, along which a narrow white line (of transparent cells) runs. The dorso-median pair are broadly elliptical, situated close together with only one quadrate area intervening and inclined to the median plane at an anterior angle of about 30°. The dorso-lateral pair have the same form, but are of slightly larger size, being the largest of the segmental sensillæ. They are separated from the dorso-median by three or four quadrate areas, and lie almost exactly midway between the marginal line and the latter. They incline to the median plane at an angle of approximately 45°. The dorso-marginal are long and narrow and their inclination to the median plane approaches closely, or even reaches, 90°; they are commonly separated from the last described by three quadrate areas. Much smaller are the supramarginal organs, which vary much in shape, size, and position.

The ventral sensillæ are all of approximately equal size and similar shape; the ventro-lateral have an inclination of about 35° and the others of about 90° to the median plane. The ventro-lateral and ventro-marginal lie closer together and nearer to the median line than the corresponding organs above. Of course, the angles of inclination vary and in any case can not be measured very accurately, so that the angular inclinations given are only approximate. The sensillæ situated at the margins of the body are peculiarly inconstant. Frequently one is represented by two or three smaller ones, or may become minute or altogether suppressed, or two may apparently unite into one, which occupies an intermediate position.

Toward the anterior end the first incomplete somite met with is No. VIII. Annuli *a*2, *b*5, and *b*6 are precisely as in the following somites. On the dorsal side *b*1 and *b*2 are still distinct, but much shorter, and the furrow which separates them has become faint. On the ventral side the furrow extends only a short distance mesiad from the margins, but the two rows of sense organs are apparent almost to the middle line, at which point the ring becomes entirely undivided, representing *a*1. On somite VII the corresponding annulus exhibits a slight trace only of the furrow *b*1 *b*2 on the middle of the dorsal surface, but two rows of sense organs persist to the margins or even onto the ventral surface. Annuli *b*5 and *b*6 present exactly the same condition as do *b*1 and *b*2 of the succeeding somite (VIII). VI is a typically triannulate somite above, but on the middle part of the ventral surface the furrow between *a*1 and *a*2 has disappeared. The distinction between these two annuli is preserved across this space, however, by the persistence of two series of sense organs. On the dorsal side the presence of double series of sense organs on *a*1 and *a*3 suggests the growth potentiality of these rings also. On this somite the sensillæ of the dorso-lateral pair become modified as the last pair of eyes, which are the smallest of the series and have their axes directed outward and backward. Somite V is biannulate dorsally, with a faint partial furrow incompletely dividing the anterior annulus into two. Anterior to this furrow is a complete transverse series of non-segmental organs, and posterior to it another and the metameric organs, including a pair of eyes. Ventrally this somite bounds the mouth posteriorly and is represented by a single annulus. Somite IV is also biannulate. The two annuli are of nearly equal width, or the first slightly the wider. That the latter represents *a*1 and *a*2 seems evident from the presence of traces of a furrow passing anterior to the eyes and lateral sensillæ, and by the presence of an additional series of organs anterior to this furrow. The dorso-median sensillæ have moved forward slightly anterior to the traces of this imperfect furrow. Somite III is very imperfectly biannulate, the faint cross furrow not continuing to the margins. The non-segmental sense organs, though reduced in number, form two complete transverse rows. This somite is further interesting because it bears two pairs of eyes, the outer belonging to the dorso-lateral series and being the largest and most anterior of this series. They are crowded toward the posterior margin of the anterior incomplete ring. The second pair of eyes represent the dorso-median sensillæ and have moved forward to become included in a common pigment mass with the eyes on somite II. Whitman ('92) has described a similar condition in *Clepsine* (*Placobdella*). The eyes of this sixth pair are of small size and were detected only upon the examination of sections. Somites I and II are only imperfectly separated by a partial and slight furrow, which in many cases appears to be wanting altogether. The first pair of eyes is situated on the posterior part of the annulus representing II, but the other metameric sensillæ are very small and difficult to distinguish from the scattered organs.

Considering the anterior end as a whole it will be seen that the transition from the uniannulate or even coalesced somites of the prostomium and lip to the complete quinque-annulate somite is a very gradual one. The appearance of a new ring is first heralded by the gradual separation of an additional row of non-metameric sense organs, then by the appearance in the dorso-median region of a faint furrow, which travels toward the margins, becomes gradually deeper, and creeps around to the ventral side toward the median line, where it finally becomes complete. These processes are always more advanced[1] in the posterior than the anterior portion of the somite, and in every stage of development, from the beginning biannulate somite III to the nearly complete somite VIII, the portion of the somite posterior to *a*2 is more fully developed than the anterior portion.

At the posterior end (pl. 12, fig. 3) the series is run through more rapidly, and owing to the crowding of the annuli the arrangement of the non-metameric organs could not be satisfactorily worked out. Somite XXIII is complete. On XXIV the two posterior annuli (*b*5 and *b*6) are short and the dividing furrow faint or sometimes obliterated in the middle part. Somite XXV is quadri-annulate, *b*5 and *b*6 being represented by *a*3; *b*1 and *b*2 are also shorter and not fully developed on the ventral sides. These two somites, therefore, are more differentiated anteriorly than posteriorly; that is, like the anterior somites they are developed from the end toward the center of the body. There is a sudden change from the four rings of XXV to the two of XXVI, and there is here no definite clue to the whereabouts of the rings (*b*1 and *b*2) which, as such, are wanting in somite XXVI and in XXVII, which is precisely similar. These two somites also differ from those which immediately precede them in their stronger posterior development. They may, therefore, be compared with the anterior biannulate somites III, IV, and V, in which the easy transitions show conclusively that the annuli *b*1 and *b*2 belong potentially to that portion of the anterior and usually larger annulus which lies anterior to the metameric sensillæ. The almost universal position of the latter on the posterior part of the annulus gives added force to this view. The resemblance of such biannulate somites to the complete somites of *Microbdella* has already been pointed out (Moore, 1900), and it need only be added that the persistence of this type of somite at both ends of the leech's body, under mechanical conditions which appear to stimulate neighboring somites to growth in opposite directions, is significant of a probably phyletic meaning.

Three and sometimes even all four pairs of the dorsal sensillæ may be traced serially on the posterior sucker; but they are very irregularly developed, sometimes multiplied by division, sometimes reduced in number by concrescence or suppression and always variable in position, so that they have little value in the determination of metamerism (pl. 12, fig. 3).

Color.—The smaller examples only present a distinct color pattern, which becomes more obscure and diffuse with increase in size. Some specimens have been preserved in formalin, and the colors are described from these; but they probably have undergone some alteration, so that only the pattern is significant. Of a specimen measuring 22 mm. in length the ground is a clear reddish clay color, becoming a dull orange on the ventral surface, where it forms a continuous uniform area occupying about two-thirds of the width of the body and entirely uninterrupted by any markings. At the sides this area is delimited by a pair of sharply contrasting broad bands of dull black, in the borders of which are scattered some irregular spots of deeper black. External to the black bands, and marking the exact margins of the body, are two narrower bands of the ground color, but somewhat paler than the ventral surface. The dorsal color pattern produces a very beautiful effect. Briefly stated, it consists of five dark longitudinal bands, separated by four of the ground color, which also appears more or less within the dark bands. Of the five latter the unpaired one is the widest and is divided along the median line into halves by a regularly broken line of vivid black, which is flanked at intermetameric intervals by pairs of black spots. A pair of narrower supramarginal bands bear upon their outer flanks regularly arranged outstanding black spots, between which and the yellow marginal stripes the ground color becomes of a nearly pure olive. The intermediate bands, or second pair, are still narrower and are situated about midway between the median and supramarginal bands.

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[1] It is assumed for descriptive purposes that the process of development is a progressive one by increasing complexity from before backward.

Inasmuch as the color pattern of this species throws much light on the character of the segmentation of the body a further description, especially of its metameric features, is now given. When further analyzed each of the dark bands is seen to be composite, being constituted of longitudinal elements or narrower lines, which are the result of the greater or less admixture of black pigment with the ground color. In general the dark pigment is more dense along the margins of the bands, resulting in the formation of narrow black borders to sooty or clouded olive stripes. The bands are further made up of serial units, the metameric and intermetameric distribution of which is expressed in each by an evident tendency to widen in the middle and to shrink or even become suppressed at the ends of somites. Each band consists, therefore, of a series of metameric enlargements, alternating with constrictions, which are here termed intermetameric because they extend over the contiguous portions of two adjacent somites (as somites are determined in this paper). In complete and typical somites the metameric elements belong to the three middle annuli (*b*2, *a*2, and *b*5), while the intermetameric are confined to the first and fifth (*b*1 and *b*6); but in the entire series the last annulus of one somite is united with the first of the succeeding somite in respect to color effectiveness (pl. 12, fig. 4).

The metameric elements (fig. 4) are found: (1) In both borders of the middle and intermediate bands and the ental border of the lateral, all of which become much more sharply defined or of a deeper black in the three middle annuli and more diffuse and obscure or entirely suppressed on the terminal annuli. (2) In the median black line, which, as above noted, is not continuous, but formed of a series of short black dashes, each of which is a bold distinct stroke extending over the three middle annuli and interrupted by light areas on the first annulus and the fifth. Usually there is no blending of successive dashes, but sometimes the intervening areas become more or less suffused with black pigment, which is more likely to occur on the first than on the fifth annulus. (3) In the black spots which lie on the outer borders of the lateral bands. These are of a deep black color and occur constantly on the second (*b*2) and fourth (*b*5) annuli, respectively anterior and posterior to the dorso-marginal sensillæ, around the internal side of which they are connected by a delicate arch of black pigment. To these positive elements may be added some negative elements: the light spots of more or less pure ground color which are included within the widened portions of all the bands, viz., a pair flanking each segment of the median black line of the unpaired band, a series of similar spots in each of the intermediate bands, and less distinct ones in corresponding positions in the lateral bands.

The intermetameric elements (pl. 12, fig. 4) of the lateral and intermediate bands are the rather negative features of the contracted regions on the first and fifth annuli. Here the black borders lose their intensity, and the black pigment becomes diffused and distributed almost uniformly across the whole width of the bands, thus separating from one another the light serial spots above mentioned. In the corresponding parts of the median band the black pigment becomes largely concentrated into a pair of intense spots, extending over the fifth (*b*6) and first (*b*1) annuli, and including between them a more or less clear light spot, the repetition of which causes the series of breaks in the median black line above mentioned.

On the incomplete somites at the anterior end all of these markings may be distinguished, and as they retain their exact relative positions they afford an important clue to the homology of the developed annuli. All five of the bands become more distinctly constricted intersegmentally, the intermediate pair finally breaking into two series of elliptical spots and the lateral similarly into series of crescents, the horns of which embrace the dorso-marginal sensillæ. On somite VIII, in which the annuli *b*1 and *b*2 are incompletely developed, the median black dash extends over *a*2, *b*5, and the posterior half (representing *b*2) of the first annulus, while the paired spots are confined to the anterior half (*b*1) of this annulus. The black pigment of the intermediate band is entirely, and that of the lateral band nearly, absent from the fifth (*b*6) annulus, while the anterior portion of the first or double annulus (*b*1 and *b*2) is also free from black pigment. On the triannulate somites VII and VI this arrangement is still more striking, and the exact composition of the first and third annuli is indicated by the extent of the metameric and intermetameric pigmentation. The median black dash, the intermediate ellipses, and the lateral crescents on each occupy the middle annulus and about the adjacent one-half of the third (*a*3) and two-thirds of the first (*a*1) annuli, while the paired intermetameric spots are confined to exactly the remaining fractions of annuli *a*1 and *a*3. These parts have exactly the values which were assigned on other grounds to *b*1 and *b*6 in the composite annuli. Even on the biannulate somite V the pattern remains; the median dash becomes a mere spot, which occupies about the posterior three-fourths of the first (*a*1 and *a*2) and the anterior half of the second (*a*3) annulus. Anterior to this the median line becomes continuous over somites IV and III to a point between the first pair of eyes, where it meets the light color of the lip margin. The remains of the intermediate and lateral bands, and especially the intermetameric spots of the median band, serve to define the potential annuli even on somite IV, the last named extending onto the posterior part of III. It will be seen that the study of the color pattern of this species confirms to the last detail the values which were assigned to the annuli as a result of the study of sense organs, integumental furrows, etc. Further, it affords support to the neuromeric standard for limiting the somite.

At the posterior end of the body a similar relation between the color markings and the somite constituents appears to be maintained, but the condition of the material prevents its being satisfactorily worked out. The posterior sucker is marked above by an irregular ring of black inclosing a light spot and flanked by a few black rays; the ventral surface is ash-colored, with a few small scattered black spots, mostly near the margin.

Small specimens are still brighter in color. The ground is purer and clearer, sometimes paler, sometimes redder, and the black markings relatively deeper and more vivid. As the size increases there appears to be a progressive tendency for the black pigment to diffuse over the entire dorsal surface, changing the ground color to a dull olive and entirely obscuring the markings, though the more important black spots may always be found. The largest specimen is of a nearly uniform brown olive, with faint darker cloudings, spots, and broken lines, among which may always be distinguished the median series of dashes, the paired intermetameric spots, and the lateral spots. They are very obscure, but sufficient to show the persistent impress of the original pattern.

Alimentary Canal.—The mouth cavity is bounded posteriorly by three broad triangular folds, a single median ventral and a pair of dorso-lateral, together forming a diaphragm, through the limbs of the trifid aperture of which the anterior edges of the three jaws are usually visible. Slight grooves run along the bases of the dorsal folds and meet in a triangular expansion of the median labial margins.

Except that the median dorsal jaw is somewhat lower, the three jaws (pl. 12, fig. 5) are of similar shape—long, low, and compressed, with the edge only slightly convex. They are strongly angulated anteriorly, where they pass abruptly into the supporting plate, but recede more gently behind. The denticles (pl. 12, figs. 5 and 6) are very small, triangular plates set transversely on the jaws, and number from 160 to 180 on each jaw in the two examples which were examined. They are largest anteriorly, where they measure 0.03 mm. in height, and diminish gradually to one-half that height at the posterior end. Along the sloping sides of each jaw are considerable numbers of button-shaped papillæ supported on narrow stalks. They vary in size, the largest being about 0.07 mm. in diameter, the smallest about one-fourth that size. Most of them are arranged somewhat in three irregular rows (fig. 5) of about ten each, between which some smaller ones are scattered. They appear not to be sense organs, but serve as places of exit for some of the ducts of the pharyngeal glands, most of which traverse the interior of the jaw and open on its ridge between the teeth. Possibly it is due to the great number and crowding of the denticles that additional outlets are required for the glands.

The muscular œsophagus is marked by six longitudinal folds, the three which correspond to the jaws being larger than those which alternate with them. It reaches to somite IX. There are ten pairs of gastric cæca developed, as in *Hirudo*. The last originates in XIX, is large, sacculated, and extends caudad. None of the smaller cæca are much sacculated. That this species is a true bloodsucker is shown by the presence of blood in the cæca of all specimens examined.

Reproductive Organs.—A general view of the reproductive organs is shown in pl. 12, fig. 7. The male organs do not differ in any important respect from *Hirudo*, though the sperm sacs (*de*) are larger.

There are eleven pairs of testes (*t*1–*t*11) resting on the ventral longitudinal muscles on each side of the nerve cord and immediately behind their corresponding ganglia. The sperm ducts (*vd*) lie on the floor of the body just external to the testes, and, owing in part to the contraction of the body, are greatly convoluted. At the posterior end they extend beyond the last pair of testes as short, blind tubes, but a sufficient number has not been dissected to show that this is a constant feature. At the anterior end the ducts become much smaller, less glandular, and less convoluted. In somite XI they bend back on themselves and immediately become wide, irregular, closely convoluted tubes, forming rather compact masses, the epididymés (*ep*). At their posterior end these again pass into the small ends of the conspicuous fusiform, muscular-walled sacs, the ducti ejaculatorii, or sperm sacs (*de*). Finally the two sperm sacs unite in a common penis sheath (figs. 7 and 8 *ps.*), which is a thick, muscular, pyriform sac bent sharply forward on itself and attached to the ventral body wall at the male orifice. There is a long coiled-up penis, but in no cases was it found to be protruded. Prostate glands are scarcely evident, only a few solitary unicellular glands opening into the bulb of the penis sheath.

The peculiarities of the female organs (pl. 12, figs. 7 and 9) have already been mentioned in the generic description. The vagina (*vg*) is cylindroid in younger specimens, but becomes much enlarged at the blind end, with a relatively narrow neck (fig. 9) in fully mature examples, in which also it may become doubled on itself. The two "ovaries" (*ov*) lie about equidistant from the middle line and their ducts empty into a common oviduct with a small albumen gland (*gla*). The common duct is short and folded into a compact coil which is bound to the anterior wall of the vagina, with which it opens, but by a separate orifice, into a small and probably eversible female bursa (*b*).

The female organs of *H. javanica* are shown on pl. 13, figs. 18, 19, and 20. The specimen, although much larger than that from which fig. 7 was drawn, is much less mature. The structure of the organs is in every respect similar. The vagina is marked by longitudinal wrinkles and it projects upward almost vertically from the ventral body wall, carrying the nerve cord with it.

Several specimens (about fifteen) of various sizes were taken from a bottle labeled "Cagua 1-10-99."

DIPLOBDELLA, gen. nov.

The leech for which this genus is proposed belongs to the monostichodont *Hirudinidæ* and differs in several respects from all members of this group whose internal anatomy has been described. The sperm ducts of the two sides remain entirely distinct almost to the external orifice, with which they are connected by a very short canal. There is no definite and distinct penis sac, and if the common canal is eversible at all it can form only a very short penis. There is a remarkable development of gastric cæca, most of the complete somites as far back as XVIII having two pairs in place of the one usually present. These are always very obvious and the two pairs are of equal length in some of the postgenital somites. There is frequently a tendency for most of the annuli to become faintly subdivided. (See pl. 13.) This disposition toward the doubling of organs has suggested the name.

The nearest ally of *Diplobdella* known to me appears to be *Philobdella* Verrill. This genus has the sperm ducts similarly separated almost to the external orifice, the prostate glands very large, the jaws high and few toothed, and the color pattern similar. But it differs in the complicated copulatory glands and pits, in the much simpler lobing of the stomach, the form of the ovaries and vagina, and, in the known species, in the location of the sex pores and some details of annulation. *Macrobdella* Verrill possesses the two pairs of gastric cæca per somite, but the male reproductive organs are quite dissimilar.

None of the numerous descriptions of *Hirudinidæ* from South and Central America, etc., appear to fit the type species, which is therefore described as

Diplobdella antellarum, sp. nov.

Diagnosis.—The sex pores are separated by 3½ rings, the male being situated at $\frac{\text{XI}}{\text{XII}}$, the female at the middle of XII *b*5. There are about 35 denticles on each jaw. Annulus XXVI *a*1 is developed at the margins. Annulus IV *a*3 is frequently imperfectly differentiated. The colors are plain ventrally, longitudinally striped above.

External Characters.—When fully extended this leech is slender and the sides of the body nearly parallel for a long distance, as in a nephelid; when strongly contracted, which is the state of most of the specimens, the body is nearly elliptical with bluntly rounded ends. Whether contracted or extended, the body is always flattened, quite unlike the thick rounded form assumed by *Hæmopis*, etc., when contracted or resting. The largest extended specimens are over 3 inches long. The selected type specimen has the following dimensions: Length, 55 mm.; greatest width (about XVIII), 8.5 mm.; greatest depth, 3.8 mm. (about); diameter of sucker, 5.4 mm.; width of upper lip at base, 2.3 mm.

There are 105 distinct annuli, counting one which appears posterior to the anus. In many specimens most of them are marked by a transverse depressed line, making them faintly double. The annuli are smooth, in no case exhibiting the prominent papillæ so characteristic of the species last described, although in some cases examples of the two species had been killed and preserved together.

In marked contrast to *Hirudinaria blanchardi* the mouth is relatively small. The upper lip is slightly wrinkled on the margin, but nearly smooth below, and undivided by a median sulcus except at the base. Dorsally it is seen to consist of the first four somites, the coalesced annuli of the fifth bounding the mouth posteriorly.

The five pairs of conspicuous eyes (pl. 13, fig. 10) are disposed as usual in the family. The different directions toward which their pigment cups face is especially evident. The first pair look directly forward, the second forward and slightly outward, the third outward, the fourth outward and backward, and the fifth backward and slightly outward.

The male pore is situated on a small, more or less prominent cone rising from the contiguous parts of somites XI and XII, between which the orifice lies. In no case does a penis protrude, and there are no copulatory glands. The female pore opens through the middle of the fourth annulus (*b*5) of somite XII. (Pl. 13, fig. 12.) None of the specimens show a clitellum.

The anus has the usual position behind somite XXVII, but XXVIII appears as a distinct ring bounding it behind. The sucker is relatively small, thin, very flat, rather narrowly attached, and much more broadly free posteriorly than anteriorly (pl. 13, fig. 11). The usual 17 pairs of nephridiopores appear as short oblique slits on the posterior margins of annulus *b*2 of every somite from VIII to XXIV, inclusive (figs. 10 and 11). The first 16 pairs are just ectad of the ventro-marginal sensillæ; the last pair is peculiar in being distinctly more mesiad.

Annulation.—The details of annulation are sufficiently shown in the diagrams (pl. 13, figs. 10, 11). Attention is directed to the following points: Somites II and III are very short, with no trace of more than one annulus each. The second annulus (*a*3) of IV is sometimes very imperfectly separated. On the ventral surface V is uniannulate and VI biannulate. VIII*a*1 is very large, but always entirely undivided; XXVI *a*1 is separated at the margins at least, the first annulus (*a*1 + *a*2) of XXVII is very broad, and its sensillæ are far posterior, and, lastly, XXVIII appears as an annulus distinct from the sucker.

The metameric sensillæ (pl. 13, figs. 10 and 11) are small and round as in *Hæmopis* and *Hirudo medicinalis*, but are generally easily found. The dorso-lateral are much larger than any of the others. Their arrangement is shown in the figures, the three ventral pairs on somite XIV (fig. 10). Sensillæ are very numerous on the dorsal surface of the sucker, all of the eight dorsal series being well represented. As usual, they are variable in number and position and show evidences of multiplication.

Color.—The pigmentation is described from formalin specimens, which have probably faded considerably. The colors are very quiet and the pattern simple, but both tint and arrangement vary greatly. The ventral surface is of a uniform ash, which sometimes has a distinctly reddish tint, in which case there is likely to be a slight submarginal band clouded with black. A narrow yellowish band varying in intensity extends along each margin. Dorsally, the ground color may be just like the ventral or it may be darker or tinged with yellow. In a typical example there are three pairs of dark longitudinal bands, which together occupy about two-thirds of the width of the dorsum and unite at the ends of the body. They are of an olive color bordered by narrow margins of brown. The innermost pair are the broadest and are separated by a narrow but distinct line of yellowish. The intermediate pair is slightly and the lateral pair much narrower, and the latter is frequently broken and interrupted by intrusions of the ground color. Between the dark bands the intervening strips of ground color are very narrow, and broken here and there by bridges of the dark pigment, which cross more frequently between the lateral and intermediate bands. Such connections are most likely to occur on the fourth annuli of somites, but the pigmentation of this species appears to have no constant metameric characters. All of the dark bands coalesce in a single spot of pigment which surrounds the anus and extends onto the sucker in the form of a crescent.

The extreme of color on the one hand is found in a type in which the pigmented bands become of an inky black, the median yellow line is almost obliterated, and an additional dull black supramarginal line appears, and on the other in an example in which the dorsal markings have become very obscure and pale, so that the entire animal is of a nearly uniform reddish ash color. Intermediate examples are found.

Alimentary Canal.—The jaws are much like those of *Hirudo*, conspicuous, high, short, and compressed, bearing a relatively small number (about 35) of denticles arranged in one series (pl. 13, fig. 13). They are much larger on the anterior part of the jaw, becoming smaller and relatively broader posteriorly, where they are succeeded by several imperfectly developed ones. All of the functional denticles bear recurved calcareous tips. There are no lateral papillæ, but all of the gland ducts empty on the jaw ridge between the teeth (fig. 13).

A very remarkable feature of the alimentary canal is the extensive development of gastric cæca. Each complete somite from VIII to XVIII contains two pairs instead of the one pair only, which is usual. In the more anterior of the somites named these cæca are of relatively small size and are irregularly developed, but in the more posterior the cæca of the two pairs are of equal and large size, and considerably lobed. The last cæca arising in XIX, as usual in the *Hirudinidæ*, are very large and extend posteriorly by the sides of the intestine into somite XXIV (pl. 13, fig. 17).

Reproductive Organs.—Ten pairs of testes (pl. 13, fig. 14, *t1*–*t10*) occur in as many somites (XI to XX). The last are very small and terminate the sperm ducts. The latter (*vd*) have a narrow muscular (?) section in somites XI and XII. The epididymes (*ep*) are large curved masses which open into sperm sacs (*de*). The sperm sacs themselves (figs. 14, 15, and 16, *de*) are comparatively small, and present the remarkable feature of being closely bound together by muscular and especially by connective tissue sheaths. Moreover, they are concealed from above by a thick layer of prostate glands (*pgl*) which completely cover them dorsally, laterally, and posteriorly, and which open by numerous ducts into the sperm sacs themselves. In a dissection the epididymes appear to terminate in a somewhat massive median body which, by sectioning, is found to include the sperm ducts, as just described. The common median portion of the sperm ducts, corresponding to the penis sheath of most *Hirudinidæ*, is a very short atrium with very thick muscular walls (*mb*) and a rather wide lumen lined by a somewhat folded epithelium (*m*). There is no indication of a long filiform penis, such as occurs in most jawed leeches, and while the lining of the atrium is probably eversible, it could form only a very short, rather wide penis. The structure of the whole region would appear to adapt it better to the production and placing of spermatophores, as in *Glossiphonia*, rather than for copulation as practiced by *Hirudo*.

The female organs are like those of *Hirudo*, etc. The vagina (*vg*) and slightly folded common oviduct (*odc*) lie to the right of the nerve-cord, ventral to which the left oviduct crosses to join the latter.

Like *H. blanchardi*, this species is a blood feeder, as is evidenced by the presence of blood in the cæca, etc. A large number of specimens were collected at San Juan on January 12, 1899, and at Cagua on January 10, 1899. It also occurs on the American continent, as I have received from Professor Harold Heath, of Leland Stanford University, examples collected by R. C. McCregor in January, 1896, at Panama, Colombia. The drawings of the internal anatomy were made from the latter.

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DESCRIPTION OF FIGURES.

PLATE 12.

Figs. 1 to 9 represent *Hirudinaria blanchardi*.

FIGS. 1, 2. Ventral and dorsal views, respectively, of a typical large specimen, × 5. The somites are indicated by Roman numerals on the left; the numbers on the right are of the annuli, counted from the prostomium, while the symbols included within parentheses show their theoretical value. The eyes and metameric sensillæ are shown in heavy black, the "goblet-shaped sense organs" and the "conical sense organs" as small dots. Except that all of the goblet-shaped organs are not represented, the position and number of the sense organs is indicated as accurately as possible. An attempt has also been made to have the boldness of the lines correspond with the depth of the interannular furrows.

FIG. 3. A semidiagrammatic view of the dorsum of the posterior end of the same specimen, × 5. The metameric sense organs only are represented. The dotted line across annulus xxiv *a3*, indicates its partial subdivision into two. The somites and annuli are indicated as in fig. 2.

FIG. 4. Slightly more than the right half of somites xv and xvi of the largest specimen, × 3. The whole surface, dorsal and ventral, is shown as though flattened out, and every topographical feature of xv has been drawn with the greatest care. On xvi and on the middle portion of xv the color pattern of a small specimen has been plotted to show its relation to the sensillæ, etc. The intensity of the black pigment is indicated by the closeness of the stippling. *dm*, dorsi-meson; *m*, extreme lateral margin; *vm* (the exact margin of the figure), the ventrimeson; *np*, nephridiopore; *md*, median-dorsal; *dl*, dorso-lateral; *dma*, dorso-marginal; *sm*, supra-marginal; *sbm*, submarginal; *vma*, ventro-marginal; and *vl*, ventro-lateral sensillæ.

FIG. 5. A median dorsal jaw, × 33. Outline as seen from the right side. The teeth and papillæ are shown.

FIG. 6. Transverse section of a jaw shown in outline, × 33. The cut is near the anterior end, and shows one of the larger denticles and the central mass of gland ducts which open partly on the dentigerous margin, partly on the lateral faces of the jaw. *d*, denticle; *p*, papillæ; *gd*, axial mass of ducts.

FIG. 7. Partial representation of the reproductive organs from the dorsal aspect, × 6.5. On the left side the first testis only is shown, and the ductus ejaculatorius is drawn forward to show the epididymis. *t1*-*t11*, the eleven testes; *vd*, the vas deferens; *de*, ductus ejaculatorius (sperm sac); *ep*, epididymis; *ps*, penis sheath (atrium); *ov*, ovary; *odc*, common oviduct; *vg*, vagina.

FIG. 8. Outline of terminal portion of male duct, seen from the left side, × 6.5. ♂, male pore; other letters as in fig. 7.

FIG. 9. Outline of the female organs of the largest specimen, somewhat dissected, × 6.5. *lov* and *rov*, left and right ovaries; *gla*, albumen gland; *odc*, common oviduct; *vg*, vagina; *b*, female bursa; ♀, female pore.

PLATE 13.

Figs. 10 to 17 represent *Diplobdella antillarum*.

Figs. 10, 11. Semidiagrammatic figures of the anterior and posterior ends of the body viewed from the dorsum. × (about) 5. The somites and annuli with their values are indicated as in figs. 1, 2, and 3, but the metameric sensillæ are indicated by circles. On somite xiv the ventral sensillæ are shown. Sensillæ lettered as in fig. 4.

Fig. 12. The sex pores and neighboring structures. × (about) 5.

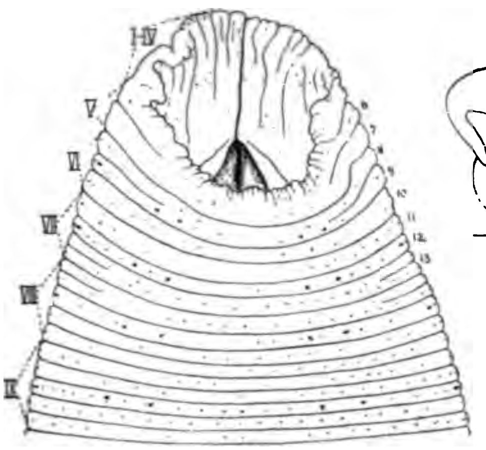
Fig. 13. A left lower jaw shown in outline and as a transparent object. × 56. The denticles, the course of the gland ducts from the central mass, and the arrangement of some of the muscles are shown.

Fig. 14. Reproductive organs from above. × 6.5. The left testes are omitted, and the lettering is as in fig. 7, except *pgl*, prostate glands.

Figs. 15, 16. Two transverse sections through the atrium. × 26. The section shown in fig. 15 is five sections anterior of 16. ♂, male pore opening from bursa; *m*, median common part of duct opening into male bursa; *mb*, muscular wall of atrium; *de*, ductus ejaculatorius; *ep*, epididymis; *pgl*, prostate glands; *lm*, longitudinal muscle layer; *cm*, circular muscle layer; *n*, nerve cord.

Fig. 17. Outline of alimentary canal. × (about) 5. The Roman numerals indicate somites, and show the extent of the several regions.

Figs. 18, 19, and 20 are, respectively, nearly anterior, ventral, and right lateral views of the female reproductive organs of *Hirudinaria javanica*. × 10. Lettering as in fig. 9.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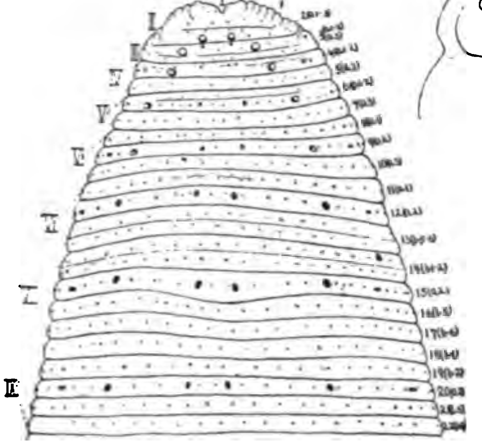
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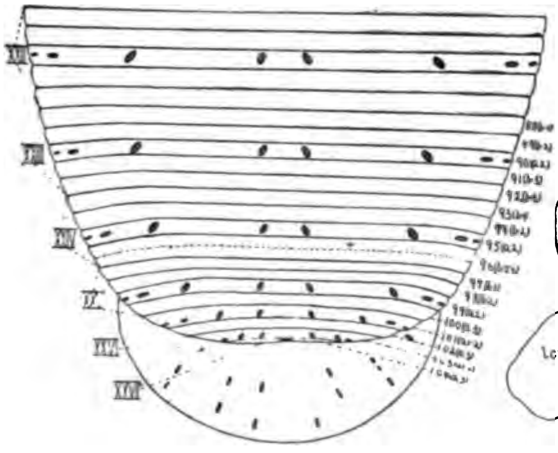
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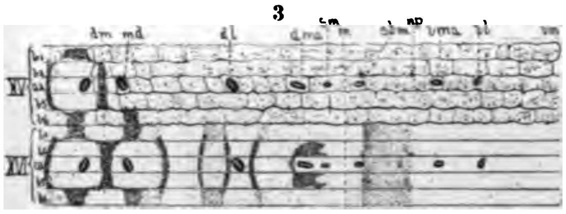
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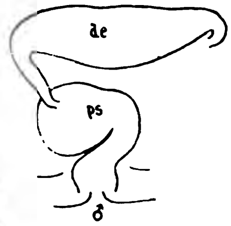
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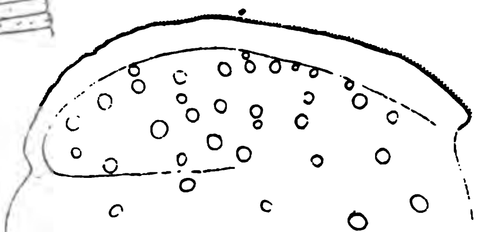

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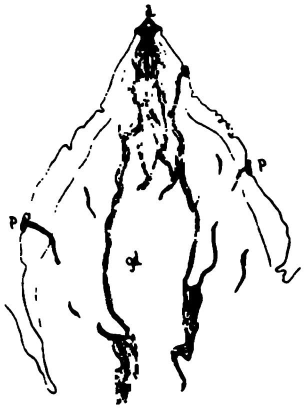
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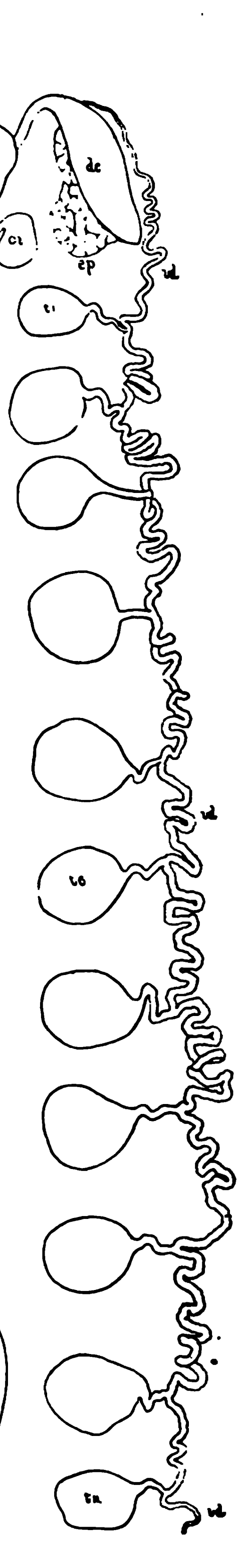
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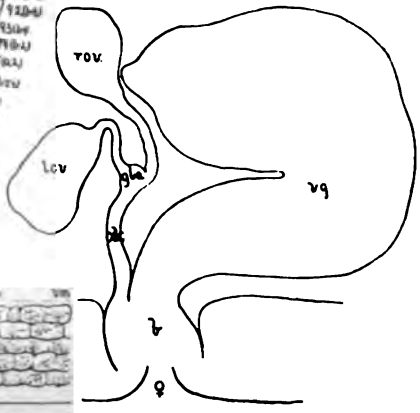
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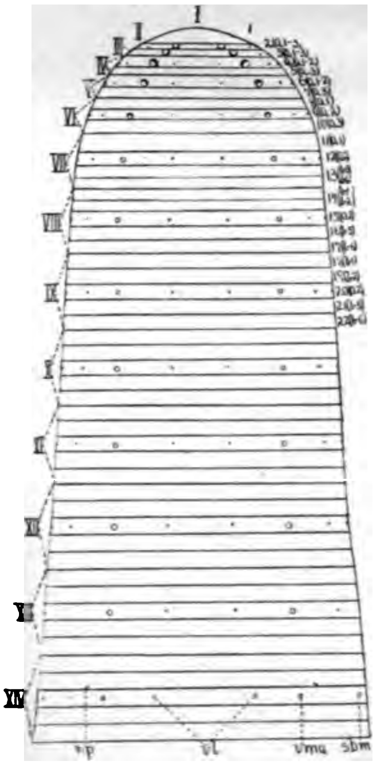

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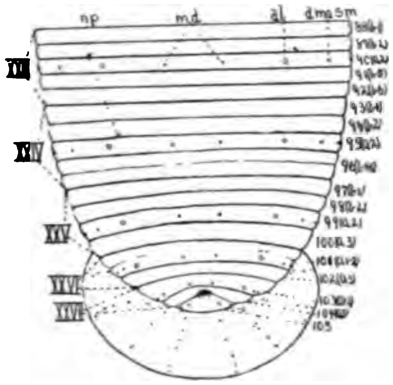

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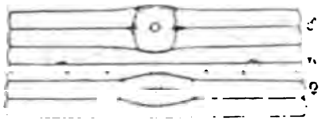

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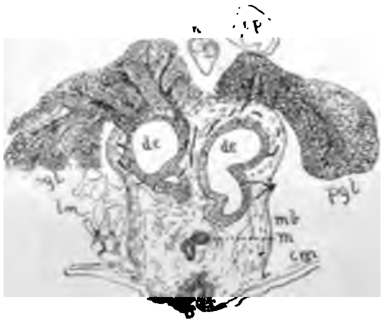

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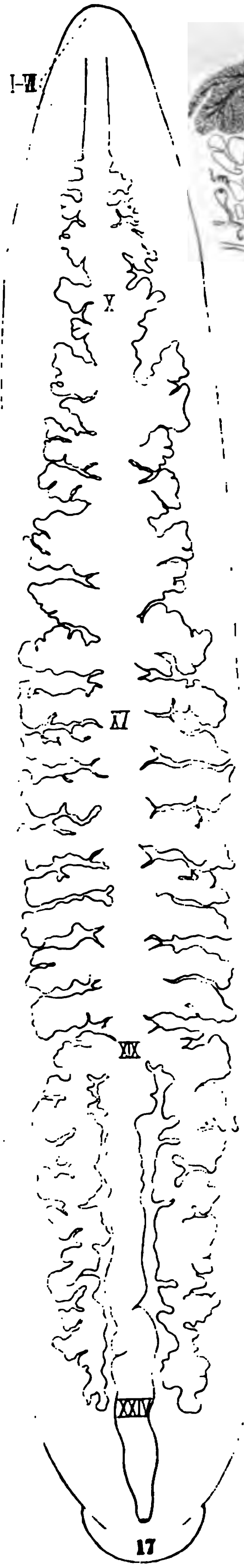

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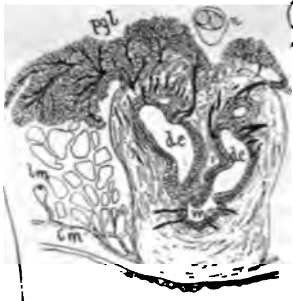

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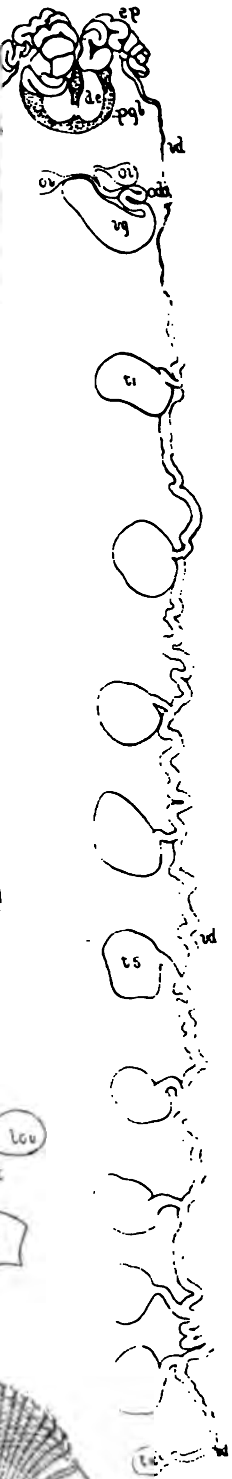

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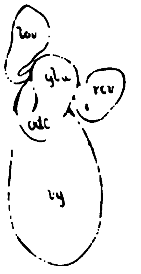

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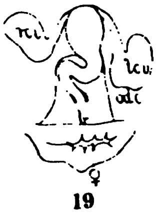

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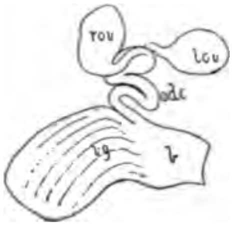

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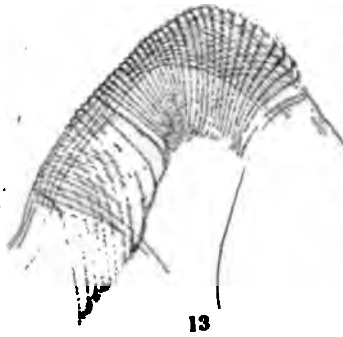

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THE NEMERTEANS OF PORTO RICO.

BY

WESLEY R. COE, Ph. D.,

Yale University.

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The collections of the U. S. Fish Commission steamer *Fish Hawk* at Porto Rico during the months of January and February, 1899, include only 15 entries of nemerteans, indicating a remarkable scarcity of this group of worms in the localities visited.[1] Eight species are represented, as follows:

1. ***Drepanophorus crassus*** (Quatr). One specimen from off Guaniquilla.
2. ***Tæniosoma delineatum*** (Delle Chiaje). One fragmentary specimen from Ensenada Honda, Culebra.
3. ***Tæniosoma discolor***, sp. nov. Two large, well-preserved specimens from Ensenada Honda, Culebra.
4. ***Micrura leucopsis***, sp. nov. Four specimens. Hucares.
5. ***Cerebratulus antillensis***, sp. nov. Several ruptured individuals. Mayaguez Harbor.
6. ***Lineus albocinctus*** Verrill. Ensenada Honda, Culebra. Two specimens.
7. ***Lineus*** or ***Micrura***, sp. indet. Several fragmentary specimens. Ensenada Honda, Culebra.
8. ***Cerebratulus***, sp. indet. One specimen. Ensenada Honda, Culebra.

Of these eight species, only three can be referred to previously described forms and three are apparently new to science. The specimens comprising the remaining two, being known only from preserved material, without color notes, presented no tangible characteristics which would lead to their ready diagnosis and can not be referred to any species. The three species described as new possess such well-marked peculiarities of color and structure that the following descriptions will doubtless render them easy of redetermination in spite of the absence of drawings.

1. Drepanophorus crassus Quatr.

Cerebratulus crassus Quatrefages, Ann. Sci. Nat. (3), vi. 1846.
Drepanophorus crassus Joubin, Faune Française: Les Némertiens. Paris, 1893.

A single specimen, which may be referred to this species with a good deal of certainty, was dredged off Guaniquilla, on coral and sandy bottom, in 8½ fathoms. The color of the preserved specimen is pale yellow, but its internal anatomy and the arrangement of the ocelli agree perfectly with those of *D. crassus*, so far as could be determined. A detailed account of the anatomy and histology of this species may be found in Bürger's monograph of the Nemerteans of the Gulf of Naples (Fauna u. Flora, Monogr. 22).

The specimen collected at Porto Rico was about 20 mm. in length. The species is found in warm waters around the whole circumference of the globe. It is common in the Mediterranean and is reported from the British Channel, Madeira, Mauritius, Samoa, Panama, and other tropical localities.

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[1] This scarcity of nemerteans is even more striking in the collections of Professor Verrill at Bermuda, where but four species are recorded (Trans. Connecticut Acad., x, p. 596-598, 1900), and in the collections of Ehrhardt at Barbados, where Bürger found but two species (Zeits. f. wiss. Zool., LXI, p. 16-37, 1895).

2. **Tæniosoma delineatum** (Delle Chiaje).[1]

Polia delineata Delle Chiaje. Memorie sulla storia e notomia degli animali senza vertebre del regno di Napoli. Naples, 1823–1829.

Eupolia delineata Hubrecht. Notes from the Leyden Museum, I, 1879.

This species was represented by a portion of a single small individual from Ensenada Honda, Culebra. This fragment includes about 25 mm. from the anterior end of the body and shows the characteristic structure and markings of the species.

Bürger (Fauna u. Flora von Neapel) records this species from Barbados, and Verrill[2] has collected it in the Bermudas. It is likewise found in the warm waters around the whole circumference of the globe—from the Mediterranean, South Atlantic, East Indies, Polynesia, etc.

3. **Tæniosoma discolor**, sp. nov.

Body of large size, rather stout, with rounded margins. One of the preserved specimens showed a conspicuous dorsal ridge, with a median groove running throughout its length.

Color.—There are no notes on the colorations of the living worms. The color of the preserved specimens is white, or grayish, with a broad, median band of darker color throughout the length of the dorsal surface. This darker band is about one-half the width of the body and appears to have been brownish or purplish in life. The sides and ventral surface were probably whitish in color.

Size.—The largest specimen was nearly a meter in length, about 8 mm. wide, and 5 mm. in thickness.

Ocelli.—The head contains numerous minute ocelli. These are arranged in two broad, irregular groups of 50 to 80 or more each on the antero-lateral margins of the head. A pair of very slight lateral grooves extend from the terminal proboscis pore (when the head is extended) along the lateral margins for a short distance. The groups of ocelli are situated on the dorsal sides of the grooves. A distinct annular groove, marking the division between the retractile snout and the parts immediately following, lies directly posterior to the groups of ocelli.

Habitat.—Ensenada Honda, Culebra, February, 1899. Two large, well-preserved specimens.

[Bürger[3] describes, from a single, headless fragment, a species from Barbados which may possibly be identical with the above. This species (*Eupolia antillensis*) was 75 cm. long and 6 to 7 mm. wide. The dorsal surface of the preserved specimen was marbled brown, while the ventral surface and sides were yellowish white or gray. In its internal organization the species reveals the characteristic features of the genus.]

Cephalic glands.—In regard to the cephalic glands, nearly always so well developed in the group, *T. discolor* surpasses nearly all others in the magnitude to which these glands are developed. They not only fill up a large portion of the tissues of the head in front of the brain, but extend back of the mouth and some little distance into the œsophageal region. In the mouth region these cephalic glands are situated within the outer longitudinal muscular layer, and encroach so greatly upon the area of this layer that they actually occupy more space than is given to the muscular fibers themselves Immediately dorsal to the mouth the glands lie directly outside the circular muscular layer, and form a mass which is, in section, four times as thick as the more superficially placed muscles of the outer longitudinal layer. On the sides of the mouth the glands are scattered irregularly among the fibers of the outer muscular layer. Behind the mouth they become gradually less voluminous, and disappear somewhat farther back. I have not seen that they discharge elsewhere than on the anterior end of the head.

Cutis.—The cutis glands also reach an enormous development. At the tip of the snout these glands are not sharply separated from the cephalic glands mentioned above, but a little way back they become separated into a sharply limited layer immediately beneath the fibrous layer of the integument. This layer of cutis glands is, in most regions, at least double as thick as the epithelial layer of the integument. Beneath the glandular layer lies the fibrous connective tissue layer of the cutis, of varying thickness, but on the whole somewhat surpassing the glandular layer in volume. The muscular layers of the body walls are as in other species.

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[1] In the Proceedings of the Washington Academy of Sciences (vol. III, p. 3, 4, 1901) I have given my reasons for adopting the generic name *Tæniosoma* (Stimpson) instead of *Eupolia* (Hubrecht), which is still used by most European writers.

[2] Trans. Connecticut Acad., X, p. 597, 1900. The species is here referred to *T. curtum*, but a number of specimens collected in the spring of 1901 undoubtedly belong to *T. delineata*. This further increases my conviction that the former is but a variety of the latter species.

[3] Beitr. z. Anat., Systematic u. Geogr. Verbreitung der Nemertinen. Zeits. f. wiss. Zool., LXI, p. 29, 1895.

The œsophagus is surrounded with numerous blood spaces of larger area than in most species.

The *cerebral sense organs* are remarkably voluminous, and lie immediately behind, and in close contact with, the dorsal ganglia. Anteriorly they extend forward beneath these ganglia, and their anterior extremities lie externally in the angle between the dorsal and ventral ganglia. A small canal leads from the anterior extremity of each sense organ obliquely forward and opens to the exterior in a shallow groove on the ventro-lateral aspect of the body a little in front of the anterior portion of the brain. The buccal nerves are very large.

The proboscis is small, and the proboscis sheath short. The muscular and other layers in each are quite as in related species.

4. **Micrura leucopsis**, sp. nov.

A rather compact species, 50 to 100 mm. long and about 4 mm. wide. The head is marked off from the succeeding portions of the body, when contracted, by a narrow constriction extending entirely around the body. The head is variable in shape and is acutely pointed or broadly rounded, according to the state of contraction. The mouth is of large size; the lips are whitish in color. The cephalic furrows are of moderate length, reaching back to the annular constriction when contracted. The mouth lies a little farther back than the posterior ends of the cephalic furrows—not reaching forward to the annular constriction. The body is somewhat flattened both above and below, but the lateral margins are rounded. The caudal cirrus is colorless and of moderate size, or rather small. The proboscis is colorless, of moderate size.

Color.—As preserved in formalin the color is homogeneous slaty blue or purplish, with a tinge of gray, except on the head. The color of the head is similar to that of the body, but is clearer and not so grayish. The tip of the snout, both above and below, is pure white (at least after preservation in formalin). This white patch surrounds the proboscis pore and extends backward a short distance along the cephalic furrows. No ocelli could be found. It is possible that such are present, but could not be detected on account of the extremely dark and opaque color of the body. After standing 2½ years in alcohol the color is still as dark as after the first month.

Hucares: Four specimens, one of which is 100 mm. in length after preservation in alcohol.

In internal anatomy this species presents very few peculiarities. The great abundance of pigment, which gives the species its very dark color, is situated mainly in the cutis. It occurs also in lesser quantities in the connective tissue among the muscular fibers, and a considerable layer of it lies just external to the circular muscular layer.

The cutis glands are well developed, and extend as a thick layer well down into the outer longitudinal muscular layer.

The brain and cerebral sense organs are as in other species. The dorsal median nerve is conspicuous.

The nephridia reach forward to the mouth, but do not extend far back into the œsophageal region. The nephridial canals are small and profusely branched. There are several remarkably narrow efferent ducts on each side, opening on the dorso-lateral aspects of the body.

[*Lineus albonasus*, which Verrill has described from Bermuda (Trans. Connecticut Acad., x, p. 598, 1900), is widely different from the above, the two species agreeing only in having the tip of the head white in color.]

5. **Cerebratulus antillensis**, sp. nov.

As preserved in alcohol the head is pear-shaped and very much flattened; the body is much flattened and has thin edges. The cephalic furrows are long and deep, reaching a little farther back than the anterior end of the mouth. Mouth of moderate size. Proboscis pore subterminal. A conspicuous pit lies exactly terminal, and this is nearly, but not quite, reached by the cephalic furrows. As seen in microscopic sections this terminal pit represents a very highly developed frontal sense organ.

Color.—In formalin the color of the body is faintly reddish, mottled thickly with brownish on the dorsal surface. Under sides and anterior margins of head paler.

Mayaguez Harbor, Pt. del Algarrobo, in sand or mud, at a depth of 161 to 172 fathoms. One specimen, much broken. Length in life was probably 100 to 150 mm.

Several fragments of the same species, two of which have well-preserved heads, were taken in sand or mud at the entrance to Mayaguez Harbor in 12 to 13 fathoms.

The posterior portion of another specimen, probably of this species, was taken in the same harbor in sticky mud at a depth of 4½ fathoms.

The internal anatomy of this species is closely similar to that of other species of the genus. A very highly developed frontal sense organ lies directly dorsal to the proboscis pore, as was mentioned above. This is situated directly between the anterior ends of the cephalic furrows and consists of a deep pit lined with specialized epithelium.

A broad blood lacuna lies in the anterior portion of the head. This divides a little farther back into two lateral lacunæ beside the rhynchodæum, as usual. Lateral and circum-œsophageal blood lacunæ as in other species. The dorsal vessel leaves the proboscis sheath a little way behind the nephridiopores, and therefore at about two-thirds the distance toward posterior end of œsophageal region.

The proboscis sheath has a very distinct inner longitudinal muscular layer and an outer layer of circular muscles.

The cutis glands are remarkably small and poorly developed. They do not reach one-fourth of the distance from the exterior to the circular muscular layer. The outer longitudinal muscular layer is much thicker than the two inner muscular layers combined.

The dorsal ganglia are very voluminous; they are nearly twice the diameter of the ventral. Each dorsal ganglion is divided posteriorly into two lobes, of which the upper, smaller lobe ends shortly, while the larger, ventral lobe continues directly into the cerebral sense organ. These sense organs are very highly developed; the canals communicating with the cephalic furrows pass at first to the internal ventral border of the sense organs, and then bend obliquely upward and outward to the lateral borders. Later the canal takes a curved course to the internal border again. Posteriorly the sense organs end blindly in the broad, lateral blood lacunæ.

The buccal nerves are large and conspicuous. The median dorsal nerve is very small.

Nephridia.—The nephridial canals are restricted to the middle third of the œsophageal region. The main canal on each side lies above the lateral blood lacuna in the angle between the proboscis sheath and the œsophagus, while a few branches pass ventrally and lie in contact with the circum-œsophageal blood spaces. A single pair of efferent ducts from near the posterior ends of the canals pass to the dorso-lateral aspects of the body, as usual.

Reproductive organs.—The genital products appear to be fully matured in January. The oviducts were then partially formed, and extended as rather wide tubes through the two inner muscular layers, but failed to penetrate far into the outer longitudinal muscular layer. The position of the oviducts is on the dorsal surface of the body and very near the middle line.

6. Lineus albocinctus Verrill.

Trans. Connecticut Acad., x, p. 598, pl. LXX, figs. 1, 1*a*, 1*b*, 1900.

The alcoholic specimen is short and thick-set, with short head, rounded body, and short cephalic furrows. Mouth just behind the posterior ends of the furrows. Color yellowish in alcohol, but gives no indication as to the original coloration, except that there is a series of narrow, transverse lines crossing the posterior portion of the body at fairly regular intervals. Proboscis slender, longer than the body when contracted, yellowish in alcohol.

Length of the contracted specimen 20 mm.; width 2 mm.

Ensenada Honda, Culebra. A more slender specimen from the same locality shows the transverse lines more distinctly, is more slender in shape, and has longer cephalic furrows.

While there remains the possibility that an examination of living individuals of these Porto Rican worms would reveal differences which would cause them to be separated from *L. albocinctus*, which Verrill has recently described from Bermuda, yet a comparison of preserved specimens from both localities indicates that they are specifically identical. The Bermuda specimens that I have seen were preserved in formalin and have retained well their original color, while in the alcoholic specimens from Porto Rico the color has almost disappeared. The Porto Rican specimens were considerably larger.

Professor Verrill's description of the living worms from Bermuda, is as follows: "Body not very long, slender, tapered posteriorly, a little flattened; head usually a little wider than body and more depressed. Ocelli small, about 4 or 5 in single series on each side of the head. Lateral fossæ large and long Color dark, smoky-brown or nearly black, crossed by about 20 white rings, which become narrow white lines in contraction; neck usually with a wider white band; head with white edges and a median white dorsal spot. Under side whitish. Length, in extension, 35 to 50 mm.; diameter, about 1 to 1.5 mm. Low-tide, among corallines."

7. **Micrura** or **Lineus** sp.

A slender species with long, slender head, long cephalic furrows reaching back slightly farther than anterior end of mouth. Proboscis large in size and nearly as long as body of the worm. Length of the alcoholic specimen 140 mm.; body rather slender, with rounded margins.

One specimen with extruded proboscis from Ensenada Honda, Culebra. Two headless fragments from the same locality may be referred to the same species. The color of all the specimens has practically disappeared.

8. **Cerebratulus** sp.

The color of the single specimen, preserved in alcohol, has disappeared. Length of the body about 50 mm.; moderately slender, especially in the œsophageal region. The head is remarkably long, slender, sharply pointed, and flat. Mouth large; its anterior end reaches as far forward as the posterior ends of the cephalic furrows. Ensenada Honda, Culebra.

THE ECHINODERMS OF PORTO RICO.

BY

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Professor of Biology, Olivet College, Michigan.

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The following account of the echinoderms of Porto Rico is based primarily on the extensive collections made by the U. S. Fish Commission steamer *Fish Hawk* in January and February, 1899, comprising considerably over 1,000 specimens and representing 85 species. The collection of crinoids is very small, but whether this is due to the difficulty of dredging in those waters or to the comparative scarcity of that group of echinoderms around Porto Rico it is impossible for me to say. The collection of holothurians is also small, but in this case there is little doubt that the difficulty of dredging is responsible. The collections of starfishes and sea-urchins, though not very extensive, probably represent with a fair degree of completeness the littoral fauna of Porto Rico in those groups. The collection of brittle-stars is large, comprising more specimens and more species than all the other groups combined, and it is doubtless very representative, at least of the littoral fauna.

I have also had the privilege of examining the echinoderms collected in the winter of 1900 near San Juan by Mr. George R. Gray. Though this collection embraces only 22 species, it includes 1 holothurian and 1 brittle-star not in the *Fish Hawk* collections. The number of species in the following list is therefore 87, of which 3 are crinoids, 11 asteroids (starfishes), 49 ophiuroids (brittle-stars), 13 echinoids (sea-urchins), and 11 holothurians. Of these, 8 seem to have been heretofore undescribed and 14 others have their previously known range extended considerably, so that the collections add not a little to our knowledge of West Indian echinoderms. About 50 of the 87 species may be classed as "littoral" forms; that is, they may be looked for in water of less than 2 fathoms depth, and nearly all of them occur in much shallower water than that, often just below low-water mark. Judged by these collections, the echinoderm fauna of Porto Rico is essentially like that of the other West Indian islands, although some of the new forms may prove to be confined to Porto Rico alone. At present we know too little of the fauna of any of the islands to draw any far-reaching conclusions.

In preparing this report two very different objects have been kept in view, but it is hoped that the attempt to combine them in one paper will not detract from the value of the work. Primarily, it is intended to present a complete report of the collections made by the *Fish Hawk*, describing and figuring the new species, and giving a full list of the echinoderms of Porto Rico. But the attempt is also made to give a brief description and account of each species, sufficient to enable anyone acquainted with zoölogy to identify them. The echinoderms are among the most noticeable and characteristic animals of the West Indies, and any visitor to the islands at all interested in natural history is sure to find specimens which it would be of interest, if not of importance, to identify. At present there is no single work, nor indeed any popular book of any kind, by means of which this could be done. The Porto Rican collections have afforded the opportunity to prepare such a paper, since they include many of the common littoral echinoderms of the West Indies. It is hoped that these very artificial "keys" may be of use, not only to travelers and to residents in Porto Rico and the other islands who are interested in marine life, but especially to students or specialists in other fields of zoölogy who may visit the West Indies and wish to know the names and history of the echinoderms with which they meet. The "keys" may also be of use in Florida and along the Gulf coast.

It must be borne in mind that our knowledge of West Indian echinoderms is far from complete, and there are doubtless many of the less common "littoral" species not included in these "keys." Specimens of such forms may or may not fit by accident into the key, but the brief account given under the name of each species will assist in preventing mistakes. There are quite a number of species which were not taken in Porto Rico, but which will very possibly be found there. Such forms have been included in paragraphs following the lists of species, with brief statements of their distinguishing characteristics, to assist in their identification if found. It is of great importance that specimens which do not answer to the descriptions here given should be preserved in spirits and if possible forwarded to the Fish Commission or the National Museum at Washington for identification. In this way the present list will be extended until it includes all of the littoral echinoderms of the West Indies.

In presenting this report I desire to express my deep appreciation of the courtesies I have received from the Hon. George M. Bowers, U. S. Commissioner of Fish and Fisheries; and also from Dr. Hugh M. Smith, of the U. S. Fish Commission.

CRINOIDEA.

SEA LILIES.

The crinoids comprise a very insignificant part of the *Fish Hawk* collections, and there are no stalked forms among them. There are not a half dozen specimens all together, although there are fragments of many arms. They represent three common West Indian species of *Comatulæ*, collected at five different stations, and may be distinguished from each other by the following characters:

A. Mouth approximately in center of disk. Oral pinnules without a "comb" near tip .... *Antedon hagenii*
B. Mouth at side of disk. Oral pinnules with a "comb" of coarse teeth on inner side near tip.
  1. Color pale. Pinnules without minute spines or hooks on each joint. .... *Actinometra meridionalis*
  2. Color red-brown, with a longitudinal black stripe on aboral side of arms. Pinnules with minute spines or hooks on each joint .... *Actinometra rubiginosa*

Antedon hagenii (Pourtales).

This has been called the commonest crinoid of the West Indies. It was first collected by Pourtales in the Straits of Florida, and has since been found widely distributed in the Caribbean Sea. The calyx is about 20 mm. across; arms 100 mm. long. There is one calyx and fragments of many arms from station 6067, where they were dredged on a coral bottom at over 100 fathoms depth. Pourtales says the color is "pale-greenish, turning white in alcohol." The fragments of arms before me are almost white, but are banded with pale brown, and near the base is a longitudinal pale-brown stripe on the aboral side.

Actinometra meridionalis (Pourtales).

Originally described by Pourtales from specimens collected in Florida Straits, but now known as a common and widely distributed form in the western Atlantic. Somewhat larger than the preceding.

There are 4 calyces of this species, with portions of arms attached, from station 6063. The longest arm measured 125 mm. There are also fragments from station 6066. This specimen was collected with a trawl on a rocky sand bottom at a depth of from 75 to 172 fathoms.

Actinometra rubiginosa (Pourtales).

First described from south of Florida, its range eastward being greatly extended by its collection at the eastern end of Porto Rico. About the size of the preceding and more handsomely colored. Fragments of arms collected with a tangle on a coral bottom at stations 6088 and 6090, at depths of 16 to 23 fathoms, seem to be referable to this species. They are dark reddish-brown, with a longitudinal black stripe on the aboral side.

Numerous other species of crinoids have been collected in the Caribbean Sea, but it is impossible to say what forms may be expected to occur in the Porto Rican waters. It is worth noting, however, that the three species collected by the *Fish Hawk* are not only all *Comatulæ* (crinoids without stalks, not attached when adults), but belong to the 10-armed series of that group. Several *Comatulæ*, having 15 to 20 or more arms, may be looked for, while other 10-armed species undoubtedly occur. Of the stalked crinoids, *Pentacrinus decorus* W. Thomson has been recorded from the "south side of Porto Rico" (Fewkes, Bull. Mus. Comp. Zool., vol. x, p. 181) and three other species of the same genus are also known from the West Indies, all collected in water of over 70 fathoms depth. The curious little *Holopus*, which has been recorded from the north side of Cuba and from Barbados, may be looked for attached to rocks in comparatively shallow water.

ASTEROIDEA.

STARFISHES.

The *Fish Hawk's* collection of starfishes is of considerable interest, although no new species were found. There are 103 specimens, representing 11 species, but one-third of these belong to a single species of *Astropecten.* With one exception the species are common West Indian forms, and the list is almost a duplicate of one published in 1898 as "The Asteroids of Jamaica" (Johns Hopkins Univ. Circ., Nov., 1898). These starfishes are readily distinguished from each other, as they represent no less than 7 families, and the following artificial key will make their determination easy, although it is worthless for any other species.

A. Rays shorter than diameter of disk, the general shape of animal pentagonal.
I. Size large, disk high .... *Pentaceros reticulatus.* (7)
II. Size very small, disk flat .... *Asterina folium.* (8)
B. Rays much longer than diameter of disk.
I. Rays more or less flattened, and spiny, at least on the sides.
a. Disk large; general form star-shaped; marginal plates of rays on upper side very prominent.
1. Marginal plates without spines.................... *Astropecten antillensis.* (1)
2. Marginal plates with erect, conical spines .... *Astropecten duplicatus.* (2)
b. Disk smaller, rays longer, marginal plates not prominent.
1. Rays 9, flat and long .... *Luidia senegalensis.* (5)
2. Rays 5, flat and long, not spiny above.................... *Luidia clathrata.* (4)
3. Rays 5, banded alternately with green or purple and yellow, somewhat flattened, long, and covered with small spines.................... *Luidia alternata.* (3)
4. Rays 5, not much flattened, short, blunt, and bearing a few (30 to 60) coarse spines... *Echinaster crassispina.* (11)
II. Disk very small, rays very slender, and almost cylindrical.
a. Rays rather blunt and quite smooth.
1. Groups of openings through skeleton arranged in regular longitudinal rows on rays.. *Ophidiaster guildingii.* (9)
2. Groups of openings through skeleton, without any definite arrangement .... *Linckia guildingii.* (10)
b. Rays tapering, and more or less spiny, at least on sides .... *Zoroaster fulgens.* (6)

1. Astropecten antillensis Lütken.

This common starfish occurs throughout the West Indies, on sandy bottoms. It is generally very light colored, whitish or pale brown, and reaches a diameter of about 175 mm. There are thirty-six specimens in the *Fish Hawk* collection, ranging from 6 to 185 mm. across. The smallest has the paxillæ with 6 or more spinelets, 4 marginal plates on each side of ray, and a Λ-shaped plate at tip; infero-marginal plates with one lateral spine, the second just beginning to appear. Specimens 12 to 15 mm. across have the second lateral spine nearly as large as the first, except on the 2 infero-marginal plates at angle of the rays; the paxillæ spinelets are more graniform. In specimens 24 mm. across the paxillæ spinelets are nearly granular. Small specimens are easily distinguished from small specimens of the next species by their flatness, breadth of rays, the paxillæ, and bluntness of lateral spines.

Collected at Arroyo, Mayaguez, and Puerto Real.

2. Astropecten duplicatus (Gray).

This species seems to occur in deeper water than the preceding around Porto Rico, but may be found with it. There are several differences between them, but the spines on the marginal plates sufficiently distinguish *duplicatus.* It reaches the same size and has the same distribution as *antillensis,* but varies more in color, being sometimes bright reddish brown.

There are 11 specimens before me, varying in size from 18 to 178 mm. across and in color from almost white to brownish orange, with feet red, green, or pale brown. The smallest has only 4 or 5 spinelets on each paxilla and no spines on supero-marginal plates.

Collected at stations 6058, 6072, 6084, 6085, 6091, and 6096; none taken in less than 6 fathoms.

3. Luidia alternata (Say).

One of the handsomest starfishes of the West Indies, often found with the two preceding. It reaches a large size, 250 mm. across, and its striking colors make it very conspicuous. There is only one small specimen in the *Fish Hawk* collection (65 mm. across), from station 6097, in 10 fathoms. The colors are purplish and yellowish.

4. Luidia clathrata (Say).

Common on sandy bottoms along the southeastern coast of the United States and throughout the West Indies, also occurring in Bermuda. It reaches a diameter of 200 mm. Color usually grayish blue above, light yellowish beneath.

Collected at stations 6054 and 6084: 7 specimens, the largest 200 mm. across.

5. Luidia senegalensis (Lamarck).

This curious and interesting starfish occurs on sandy bottoms throughout the West Indies. It reaches a diameter of over 350 mm. Upper surface grayish blue; lower pale yellow. There are 3 specimens, all with 9 rays. The largest is 365 mm. across. Collected at Cataño, Mayaguez, and Puerto Real.

6. Zoroaster fulgens W. Thomson.

A large and handsome starfish, 225 mm. across, found in deep water throughout the North Atlantic. Its occurrence in shallow water at San Juan seems quite exceptional. There are 2 very fine specimens labeled simply "San Juan," which I have referred to this species, though not without hesitation. They answer very satisfactorily to Sladen's description (Challenger Report, vol. xxx), but not so well to his figures, which, however, differ somewhat from the description, especially in proportions. The specimens before me have the rays 110 mm. long, while the radius of the disc is only 8 mm., therefore $R = 14\ r$. Perrier, in his description of *Z. ackleyi*, speaks of superficial resemblances, aborally to *Ophidiaster*, orally to *Luidia*, and in these the Porto Rican specimens agree with *ackleyi;* but they differ from that species in having only 11 longitudinal rows of plates on the rays, agreeing in that respect with *fulgens*. They also agree with the latter species in the granulation of the plates and in several other minor points, but they are not nearly as spiny as Sladen's figures. All the differences together, however, do not seem to me to warrant the separation of the Porto Rican species as new. It is unfortunate that there are no data to show at what depth these specimens were collected; it hardly seems possible that they could have been collected along shore or in very shallow water.

7. Pentaceros reticulatus (Linnæus).

This is perhaps the best known of the West Indian starfishes, being commonly brought back by sailors and travelers as a curio. It reaches a large size, up to nearly 0.5 meter in diameter. In life the color is usually yellowish or reddish-orange, but when dried it is more often brown. It occurs on sandy or muddy bottoms, in shallow water, throughout the West Indies. The *Fish Hawk* collection contains 12 small specimens, measuring from 72 to 200 mm. across. They were collected at Mayaguez, Ponce, and San Juan. Mr. Gray brought back about 50 specimens of medium size, of which 2 have 6 rays and 2 have only 4. The ambulacral furrows of the latter form a perfect cross. Mr. Gray called my attention to the fact that there are 2 well-marked varieties of this starfish, so different from each other that, were connecting links wanting, they would easily pass for distinct species. One has the rays acuminate, the disc very high, the skeleton comparatively light, and the oral surface quite spiny, while the other has the rays shorter and more rounded, the disc lower, the skeleton very solid, and covered with large tubercles; oral surface more granular and less spiny.

8. Asterina folium Lütken.

A very pretty little starfish, rarely 20 mm. in diameter, found clinging to the under side of rocks, in shallow water. The color varies greatly, blue being the prevalent shade, but red, yellow, green, and white specimens often occur. Found from Bermuda southward throughout the West Indies. One small specimen, 13 mm. across, from the reefs at Ponce, is the only representative in the *Fish Hawk* collection.

9. Ophidiaster guildingii (Gray).

Found among corals and broken rocks throughout the West Indies, but does not seem to be as common as the following, which it superficially resembles. It rarely reaches a large size, 50 to 60 mm. across being a good average. The color varies from red and yellow to purplish, brown, and white. Three average-sized specimens of this species were collected at Ponce.

10. Linckia guildingii (Gray).

A very common starfish from Bermuda southward, occurring among corals and broken rocks. It reaches a much larger size than the preceding, a big specimen measuring 200 mm. across; but it is generally much less than 100 mm. in diameter. Color very variable; some are light brown with dark blotches, some chocolate brown, some purplish brown, and some almost black. Rays very variable in size and number, a specimen with 5 equal rays being a rarity. It is not uncommon to find a single ray creeping about by itself, and sooner or later such a ray reproduces a new disk and 4 or 5 new rays. This remarkably variable species is represented by 16 specimens in the *Fish Hawk* collection and 2 in Mr. Gray's collection. Of these, 9 have 6 rays, 6 have 5 rays, 1 has 4 rays, and 2 consist of only 1 ray each. Very few have the rays even approximately equal, and in no less than 6 specimens 1 ray is so much larger than the others that it is clearly reproducing a new disk with the rays. In these the madrepore plate is usually lacking, but in one of them there are 3. Of the other 12 specimens, 9 have 2 madrepore plates, 1 has 1, and the 2 single rays have none.

Collected at Ensenada Honda (Culebra), San Juan, and Ponce.

11. **Echinaster crassispina** Verrill.

This starfish belongs to an entirely different order from the preceding. It is seldom 100 mm. across, and is reddish brown or yellowish brown in color. Its exact range is not known, but it is considered by some writers as identical with *E. spinosus*, which occurs on muddy bottoms and among mangroves throughout the West Indies. Eleven specimens from Cataño, San Juan Harbor, and Puerto Real and stations 6059, 6072, and 6091 vary much in color, from bright yellow brown to dark red brown, but agree very well in general form and appearance. The largest has $R=48$, $r=11$, $R=4\frac{1}{3}r$; the smallest has $R=18$, $r=4$, $R=4\frac{1}{2}r$. In others, $R=3r$, $R=4r$, and $R=5r$. They are all clearly representatives of Verrill's species *crassispina*. Sladen gives *crassispina* as a synonym of *spinosus* Retzius, but these Porto Rican specimens are so easily distinguished from Jamaican specimens of *spinosus*, that it seems better to use Verrill's name. The short, blunt arms, with the rather few, very coarse spines, are quite characteristic, and none of the specimens before me have the bright-red color of the Jamaican *spinosus*.

Several other starfishes may be looked for on the shores of Porto Rico, as they are common in other parts of the West Indies. They are closely related to those already listed, and may be found in similar situations. *Astropecten articulatus* (Say) may be distinguished from either of the *Astropectens* given above by the presence of a small, blunt tubercle on the marginal plates near the tip of the ray, but there are no spines on these plates. In color and general appearance this species approaches *antillensis* very closely. *Asterina minuta* (Gray) is smaller and less pentagonal than *folium*, and the color is pretty uniformly white. The plates along the edges of the furrows in which the feet lie carry 2 or 3 spines on their free margin (not 4 or 5, as in *folium*), and the plates in the interradii of the upper surface carry only 1 spine (rarely 2) instead of 3 or 4, as in *folium*.

Another starfish allied to *Asterina* is *Stegnaster wesseli* Perrier. This form is somewhat larger —20 to 35 mm. across and having the disc rather high (4 to 7 mm.). The whole animal is covered with a thick, granular skin, which conceals the underlying plates. The color is whitish. It occurs under rocks with *Asterina* and *Linckia*.

If *Echinaster spinosus* is a different species from *E. crassispina*, probably it also occurs in Porto Rico. It may be recognized by rather long, tapering arms, $R>5r$, numerous small, sharp spines, and its deep but bright red color. It is a handsome starfish, and should be easily recognized. Possibly *Asterias tenuispina*, which occurs in the Bermudas, or some other *Asterias*, may occur in Porto Rico. The genus may be recognized by the absence of marginal plates, by the irregular meshwork of the skeleton on the upper side, and the numerous spines of various sizes. *A. tenuispina* has a variable number of arms, 4 to 9, but usually 7. The color is reddish yellow, with more or less violet marking.

OPHIUROIDEA.

BRITTLE-STARS, SAND-STARS, SERPENT-STARS, ETC.

The brittle-stars make up by far the largest and most interesting part of the collection of echinoderms made by the *Fish Hawk*. There are about 550 specimens, representing 49 species, of which no less than 7 seem to be new to science. In spite of the fact that the ophiurans of the West Indies have been long and carefully studied by some of the best systematists in the world, so great is their number and so extraordinary their variety that almost every collection of any size adds something new to the list. This is especially true when collecting with a tangle, for a dredge or trawl is of little use on a bottom covered with coral, while a tangle quickly gathers up any objects as rough as the ordinary brittle-star. Of course, on sandy or muddy bottoms, where the ophiurans are buried, a dredge or trawl is better. Half of the specially interesting forms collected by the *Fish Hawk* were taken with the tangle; all but one or two of the remainder were taken with the dredge or 7-foot trawl. Aside from those which are new, there are several species of very great interest on account of the considerable extension of their range or the discovery of their presence in shallow water when previously known only from considerable depths. There are 17 species which were collected along shore, the remaining 31 having been taken at depths of from 4 to 231 fathoms. In the study of this collection Professor Verrill's recent papers on West Indian Ophiurans (Trans. Conn. Acad., vol. x, pt. 2) have been of the greatest value, and his classification and nomenclature have been adopted in the following list except in one or two instances.

The following very artificial key to the brittle-stars of Porto Rico (on pp. 240–241) is rendered more or less technical on account of the large number of species and the close relationship between many of them. Consequently it has been necessary to make use of certain terms that may not be readily understood by one not familiar with the group. These terms are herewith briefly defined in order to make the key thoroughly intelligible:

Adoral plates.—A pair of small plates at the base of the jaws, proximally close to the oral shields.

Arm-comb.—A series of very small teeth-like projections or papillæ bordering the plates of the disk at the base of the arm in the genus *Ophioglypha*.

Arm-spines.—The spines borne on the side of the arms; the number of arm-spines is the number in a single vertical row.

Disk.—The body, as distinguished from the arms, especially the upper side of the body.

Distal.—Away from the mouth; toward the tip of the arm.

Jaws.—The five triangular bodies which surround the mouth, each one made up of several plates and bearing the oral papillæ and tooth papillæ.

Oral papillæ.—The teeth-like projections on the sides of the jaws.

Oral shields.—The large plates lying one in each interradius between the bases of the arms, on the under side, just outside the bases of the jaws.

Proximal.—Toward the mouth or base of the arms.

Radial shields.—Large plates on the surface of the disk, arranged in pairs at the base of the arms; they may be very large, or small, or entirely concealed; the two shields of a pair may lie close together or widely separated.

Tentacle pores.—Openings on under side of arm, through which tentacles project in the living animal.

Tentacle scales.—Small scales, just outside the under-arm plates and close beside the tentacle pores.

Tooth papillæ.—The teeth-like projections at apex of jaw.

Under-arm plates.—The longitudinal row of plates covering the lower surface of the arms.

Upper-arm plates.—The longitudinal row of plates covering the upper surface of the arms; usually they form a single continuous series, but sometimes they are widely separated from each other, and occasionally there are additional rows composed of supplementary plates on each side.

Key to the Brittle-Stars of Porto Rico.

A. Arms not capable of being vertically coiled; disk sharply set off from arms.

I. Arm-spines short, smooth, on distal edge of side arm-plates, closely appressed to arm.
  a. Disk covered with fine granules.
    *a*1. Arm-spines 8 to 10, short, broad, equal; arms comparatively short, about 3 times diameter of disk; radial shields covered; adoral plates covered by granules.. *Ophiura brevicauda.* (2)
    *a*2. Arm-spines 7 to 8, slender, equal; arms more than 3 times the diameter of disk; radial shields covered; adoral plates naked .... *Ophiura brevispina.* (3)
    *a*3. Arm-spines 8 to 9, the lowest the longest; radial shields covered.................... *Ophiura appressa.* (1)
    *a*4. Arm-spines 6 to 8, the lowest the longest; radial shields naked; color ashy gray .... *Ophiura cinerea.* (4)
    *a*5. Arm-spines 8 to 9, the lowest the longest; radial shields naked; color purplish red .... *Ophiura rubicunda.* (5)
  b. Disk covered with scales or plates.
    *b*1. Upper arm-plates with supplementary plates on each side; arm spines 4 to 6................ *Ophiolepis elegans.* (6)
    *b*2. Upper arm-plates, without supplementary plates.
      c. Radial shields separated from genital plates by a pair of plates, which bear on their proximal edge a row of bead-like papillæ, similar to those on distal edge of radial shield. This makes the radial shields appear as though cracked transversely, each side of the crack bearing a row of little papillæ.
        Ophiothyreus goesii. (10)
      cc. Radial shields not as above.
        d. No tentacle-pores beyond the basal arm joints.
          e. Disk-scales rough and swollen; an erect spine on each of several basal arm-plates; arm-spines 2.
            Ophiomusium sculptum. (14)
          ee. Disk-scales smooth; under-arm plates persisting nearly to end of arm; arm-spines 3.
            Ophiomusium eburneum elegans. (13)
          eee. Disk-scales smooth, rather few; no under-arm plates beyond third or fourth; arm-spines 4 to 5.
            Ophiomusium validum. (15)
        dd. Tentacle pores to end of arm.
          f. Not more than 2 tentacle-scales.
            g. Small separated radial shields; 4 to 5 arm-spines, lowest longest................ *Ophiozona impressa.* (7)
            gg. Radial shields large, slightly separated; arm-spines 3 (rarely 4) subequal... *Ophiozona nivea compta.* (8)
            ggg. Radial shields large, with a blunt spine on the outer end; arm-spines 3......... *Ophiozona tessellata.* (9)
          ff. Tentacle-scales 3 or more.
            h. Papillæ of arm-comb small, almost bead-like.............................. *Ophioglypha robusta.* (12)
            hh. Papillæ of arm-comb sharp and cylindrical.............................. *Ophioglypha ljungmani.* (11)

II. Arm-spines rather long, more or less at an angle to arm, and often rough or thorny.
  a. Disk covered with little granules.
    *a*1. Disk granules coarse and uneven; no tooth papillæ; basal oral papillæ very wide; arm-spines 3.
      Ophiostigma isacanthum. (40)
    *a*2. Disk granules even; numerous tooth-papillæ; arm-spines 4 to 6.
      b. Two tentacle-scales .... *Ophiocoma echinata.* (19)
      bb. One tentacle-scale.
        c. Color almost black; under side and especially tentacles rusty red .... *Ophiocoma riisei.* (21)
        cc. Color light brown; arms banded with darker .... *Ophiocoma pumila.* (20)
  aa. Disk more or less covered with scattered spines, spinules or thorny stumps.
    *b*1. No oral papillæ; arm-spines 5 to 10, long, glassy, thorny.
      c. Disk beset with numerous trifid stumps, among which there are often a few slender spines.
        Ophiothrix angulata. (16)
      cc. Disk beset with slender spines .... *Ophiothrix œrstedii.* (17)
      ccc. Disk with a few long slender spines; arm-spines very long, slender, rough and glassy.. *Ophiothrix suensonii.* (18)
    *b*2 Oral papillæ few, rarely more than 2 on a side; arm-spines 4 to 7, smooth to the naked eye.
      d. Size large, disk over 10 mm.; color very dark; arms 5, very long; arm-spines 7..... *Ophiactis longibrachia.* (25)
      dd. Size small, disk not often over 7 mm.; colors green and white; arms usually 6, rather short; arm-spines 7.. *Ophiactis krebsii.* (24)
      ddd. Size small; colors purple and white; 6 arms; arm-spines 4 .... *Ophiactis loricata.* (26)
    b 3 Oral papillæ numerous, 4 or more on each side.
      e. Oral shield touches the side arm-plate on each side.
        f. Radial shields long, narrow, and partly covered.
          g. Arms, 5. Rows of spines closely approximate dorsally.................... *Ophiacantha bidentata.* (41)
          gg. Arms, 6. Rows of spines not approximate dorsally .... *Ophiacantha ophiactoides.* (42)
        ff. Radial shields broad and thin, one overlapping the other .... *Ophioplinthaca spinissima.* (45)
      ee. Oral shield separated from the side arm-plate by a corner of the adoral-plate.... *Ophiopristis hirsuta.* (44)
  c. Disk covered with scales or smooth skin, without spines or thorny stumps.
    c 1. Upper arm-plates with supplementary plates on each side.
      h. Color pale bluish, yellowish, or whitish; arms yellowish, banded with brown; usually a network of fine brown lines on disk .... *Ophionereis reticulata.* (39)
      hh. Color reddish-brown; arms banded with darker.............................. *Ophionereis dubia.* (37)
      hhh. Color olive-green, spotted with yellowish .... *Ophionereis olivacea.* (38)

c 2. **Upper arm-plates without supplementary plates.**
i. **Arm-spines long, glassy, numerous (8); size large (disk over 10 mm. in diameter); color dark brown** .... ***Ophialcæa glabra.*** **(43)**
ii. **Arm-spines rather short, not glassy, numerous; size medium; color various, but disk usually speckled; scales very minute.**
k. **Disk reddish or gray, spotted with black; arm-spines 6 to 7** .... ***Ophiopsila riisei.*** **(23)**
kk. **Disk grayish, spotted with orange; arm-spines 6 to 11** .... ***Ophiopsila fulva.*** **(22)**
iii. **Arm-spines short, 3 to 7; size small; arms long; color of disk grayish, arms very light; scales very distinct.**
l. **Oral papillæ 2, one on each side at base of jaw and 1 at the tip; middle of jaw edge bare; arm-spines 4 or more.**
m. **Tentacle-scale 1; radial shields twice as long as broad; 4 to 5 short, blunt arm-spines** .... ***Amphiura stimpsoni.*** **(28)**
mm. **Tentacle-scales 2; radial shields three times as long as broad; 6 tapering arm-spines** .... ***Amphiura flexuosa.*** **(27)**
mmm. **Tentacle-scales 2, at base of arm; radial shields twice as long as broad; 6 to 7 short arm-spines, 2 next to the lowest with little hooks on the end.** ***Amphiura bihamula.*** **(29)**
ll. **Oral papillæ 3 on each side, the distal one very wide; arm-spines 3.**
n. **Arms very long and slender, more than 8 times diameter of disc** ..... ***Amphipholis goesii.*** **(30)**
nn. **Arms less than 8 times diameter of disk.**
o. **Radial shields short and joined** .... ***Amphipholis limbata.*** **(31)**
oo. **Radial shields long and narrow** .... ***Amphipholis subtilis.*** **(32)**
lll. **Oral papillæ 3 or 4, subequal or the distal one smallest; arm-spines 3, rarely 4.**
p. **Tentacle-scale 1** .... ***Amphiodia pulchella.*** **(34)**
pp. **Tentacle-scales 2.**
r. **Oral shield elongate; arm-spines more or less acute** .... ***Amphiodia riisei.*** **(35)**
rr. **Oral shield ovate, broadest proximally; arm-spines flat and wide at tip.** ***Amphiodia planispina.*** **(33)**
llll. **Oral papillæ 5, unequal; radial shields widely separated; arm-spines 3.** ***Amphioplus stearnsii.*** **(36)**
c 3. **Upper arm-plates altogether wanting or consisting of a number of small indistinct pieces.**
s. **Upper-arm plates wanting; size small, disk 5 to 6 mm. in diameter.** ***Ophioscolex serratus.*** **(46)**
ss. **Upper-arm plates indistinct, of several pieces on each side; size large, disk 15 to 25 mm. in diameter** .... ***Ophiomyxa flaccida.*** **(47)**

B. Arms slender, capable of being vertically coiled; disk very small, not sharply set off from arms.

I. Color yellowish-brown; arms covered by a granulated skin .... *Astrochema oligactes.* (49)
II. Color brown and white; arms ringed by regular raised belts of close-set nodules .... *Astroporpa annulata.* (48)

The user of this key must be cautioned that it is of no value except for the species included. Moreover, in the case of large genera like *Ophioglypha*, *Ophiomusium*, *Amphiura*, and *Ophiacantha*, several species might answer to the very brief descriptions given to the Porto Rican forms, though the attempt has been made to have these descriptions reasonably exclusive. It is believed, however, that the ordinary littoral forms can be easily and accurately determined by means of this key. The characters show much more plainly in dry specimens than in fresh or alcoholic material, and this is particularly true of the covering of the disk and the upper and under arm-plates.

1. **Ophiura appressa** Say.

Very common from South Carolina and Bermuda to Brazil, found in similar situations with *O. brevispina*, which it closely resembles in size and color. Oral shields usually wider than long, but even this difference is not very constant. Small specimens of the two species are distinguishable with difficulty.

There are 27 specimens of this species in the *Fish Hawk* collection, varying greatly in size and color. Taken at Ponce, Ensenada Honda (Culebra), Caballo Blanco and Guanica, and at stations 6088 and 6093. Mr. Gray took this species at San Juan, also.

2. **Ophiura brevicauda** Lyman.

This handsome ophiuran is common in shallow water from Florida eastward throughout the West Indies, found under stones on sandy bottom. The disk may be 20 mm. in diameter. The color varies to an extraordinary degree from green or blue and white to pink and white, but most of the Porto Rican specimens are cobalt-blue and white.

O. brevicauda is represented by 25 specimens from Ponce, Ensenada Honda (Culebra), Caballo Blanco, Puerto Real, and station 6076. Mr. Gray took it at San Juan.

3. **Ophiura brevispina** Say.

This is also a variable and handsome species found with the preceding and not always easily distinguished from it. It does not reach quite such a large size and the prevailing colors are shades of green, gray, and red. The oral shields are usually ovoid in outline.

This species is widely distributed from Bermuda to Brazil. Twenty-seven specimens from Porto Rico vary in color from uniform grayish white to pink and white or green and light brown. They were collected at Ensenada Honda (Culebra,) Arroyo, Puerto Real, and stations 6079, 6080, 6086, and 6096.

4. **Ophiura cinerea** Lyman.

This rather somber-colored brittle-star is found throughout the West Indies from Florida to Brazil, occurring under rocks with the preceding forms. It reaches a large size (25 mm. in diameter), but the arms are comparatively short, not more than 4 times the diameter of disk. The color varies little, except in intensity. In large specimens the upper arm-plates are usually broken into several pieces.

Sixty-three specimens of *O. cinerea* were obtained, chiefly from Ensenada Honda (Culebra), 2 from Puerto Real. The largest has the disk 23 mm. in diameter and arms 67 mm. long. Mr. Gray found the species common at San Juan.

5. **Ophiura rubicunda** Lyman.

This large and handsome species seems to be the least common of the five members of the genus found in Porto Rico. It has been taken at the Tortugas, Cape Florida, St. Thomas, and Colon, and probably occurs throughout the West Indies, being found under or among stones and coral in shallow water. It reaches a diameter of 25 mm., and the arms are 5 to 6 times as long. The color varies somewhat, but is always more or less reddish.

Only 3 specimens were obtained by the *Fish Hawk*, but one of them is a very fine one, the disk 23 mm. in diameter, the arms 135 mm. long. It was taken at Ensenada Honda (Culebra), while the other 2 are from Ponce and station 6097.

6. **Ophiolepis elegans** Lutken.

A handsome species, reaching a diameter of 18 mm., though usually smaller; the arms are only 2 to 3 times as long. The upper surface is variegated brown, gray, and white; beneath it is pure white; the arms are banded.

O. elegans is found from South Carolina southward through the West Indies in water of from 2 to 30 fathoms depth. A single specimen was taken at station 6086. The disk is 8 mm. across and the arms are only 17 mm. long. There are 4 arm-spines on most of the joints, but 1 has 5, and a few have only 3.

7. **Ophiozona impressa** (Lutken.)

From Florida to St. Thomas and Jamaica, usually in shallow water along shore, under or among stones or coral. It reaches a diameter of 15 mm., the arms 4 to 5 times as long. Variegated dark brown and white above, pale yellowish brown beneath; arms regularly banded. Five specimens, all from Ponce.

8. **Ophiozona nivea compta** Verrill.

This species occurs throughout the West Indies in water of from 50 to 400 fathoms. It reaches a diameter of 16 mm., the arms 2 or 3 times as long. The color is whitish. In typical *nivea* the radial shields are not separated.

One specimen from station 6050.

9. **Ophiozona tessellata** Lyman.

This easily recognized species is found throughout the West Indies, but only in deep water, 60 to 300 fathoms. It is smaller than the preceding, but similar to it in color.

There is a single *Ophiozona* from station 6067, which is evidently this species.

10. **Ophiothyreus goesii** Ljungman.

This curious little ophiuran (under 10 mm. in diameter) is plain grayish-white in color. It has been taken at various stations in the West Indies, but only in water of over 80 fathoms depth.

One small specimen from station 6067.

11. **Ophioglypha ljungmani** Lyman.

Previously taken only off the coast of Brazil, where it was found on muddy bottom in 350 fathoms. The color is gray. The disk reaches a diameter of 8.5 mm.; the arms about 5 times as long. The Porto Rican specimens were taken on the north and west sides of the island on a bottom of sand and mud in 20 to 45 fathoms.

There are 5 specimens of an *Ophioglypha* from stations 6051, 6062, and 6064, which are probably this species. They differ from Lyman's description only in the shape of the under-arm plates and in the presence of but [illegible] oral papillæ (3 on each side). They are certainly nearer to this species than to *lepida*, which was taken by the *Challenger* off the Bermudas and in other parts of the western Atlantic, and which belongs to the same section of the genus. The type of *ljungmani* was taken in 350 fathoms, 9 degrees south of the equator, so that its presence in shallow water off Porto Rico is certainly noteworthy. The largest specimen before me has a disk 6.5 mm. in diameter and arms about 20 mm. long. The type of *ljungmani* had the disk 8.5 mm. in diameter and arms 45 mm. long.

12. **Ophioglypha robusta** Ayres.

This northern species is quite small, rarely 10 mm. in diameter; the arms about 4 times as long. The color in alcohol is grayish white but the living animal is said to be gray, reddish, or violet, with the arms barred. In the north it occurs from low-water mark to 18 fathoms, but the specimens from Porto Rico were all dredged in water nearly 100 fathoms deep.

A species of *Ophioglypha* was taken at stations 6050 and 6067, 1 specimen at the former and 14 at the latter. They seem to belong to this northern species, though differing slightly in the shape of the under-arm plates and radial shields. But all the specimens are small (3 to 5 mm. in diameter) and they vary more or less among themselves. It is possible they are the young of *O. acerrater*, a common West Indian species, of which no specimens were taken.

13. **Ophiomusium eburneum elegans** Verrill.

This species occurs on rocky bottoms in 75 to 500 fathoms, from Cuba to Porto Rico and southward. Color, whitish. It reaches a diameter of 12 mm.; the arms about 4 times as long.

There are 12 specimens of *Ophiomusium eburneum*, 11 from station 6070 and 1 from 6063, in the *Fish Hawk* collection, all belonging to the variety described by Verrill from "off Havana." They vary in size from 5 to 10 mm. in diameter.

14. **Ophiomusium sculptum** Verrill.

This species has been taken previously only on coral bottom, in 100 fathoms of water, off Habana, Cuba. The color is very pale grayish white. It reaches a diameter of 9 mm., the arms not quite 3 times as long.

This *Ophiomusium* is represented in the collection by 4 specimens from station 6067. They agree perfectly with Verrill's description, except that there are accessory spines on the first 3 or 4 arm joints, of which he does not speak. The differences between this species and *acuferum* Lyman seem to me to be very unimportant.

15. **Ophiomusium validum** Ljungman.

Taken at several West Indian stations in water varying from 60 to 1,500 fathoms. Koehler reports it also from the Indian Ocean "north of Lacquedives." Yellowish white in color and very stiff and hard in appearance. It is somewhat less than 10 mm. in diameter; the arms about 4 times as long.

There are 4 very fine specimens of an *Ophiomusium* from station 6070, which I have referred to this species after much hesitation. They differ from the description and figures of *validum* as given by Lyman (Challenger Report, vol. v) in several important particulars, but the differences are not such as to warrant the establishment of a new species. There are more plates on the upper surface, a few more on the oral surface, the radial shields are separated by a row of plates, and there are 5 arm-spines, of which the lowest is very small and close to the fourth, which is the longest. These specimens are thus intermediate between *validum* and *lymani*, but are clearly much nearer to the former.

16. **Ophiothrix angulata** Ayres.

This small brittle star (7 to 10 mm. in diameter) is very common from Chesapeake Bay to Rio Janeiro, occurring chiefly among corals and seaweeds. The color is extraordinarily variable, usually some shade of purple or brown, with a very distinct longitudinal white stripe on the upper side of the arm; sometimes, however, this stripe is dark or even entirely wanting.

Eighty specimens of this widely distributed and very variable species were taken at Ponce, Boqueron Bay, Ensenada Honda (Culebra), San Juan, Mayaguez, Puerto Real, Guanica, and at stations 6064, 6065, 6067, 6072, 6075, 6079, 6080, 6087, 6096, and 6098. The variety of color is extraordinary. While nearly all have the white longitudinal stripe on the upper side of the arm, one has the stripe very dark, and in a few it is wholly wanting. The ground color is usually deep purple or pale violet, but some are pale brown or yellowish white. A number have only prickly stumps on the disk and no longer spines. The smallest specimen is only 2 mm. in diameter and has arms 8 mm. long. In it the primary plates are very distinct, the radial shields are large and wholly bare, and there are only a few trifid stumps on the disk, and these are raised on little knobs. The most striking variety was taken at station 6063, where 2 medium-sized specimens were found in 75 fathoms. They are uniform pale brown and the arm-spines are very long, but there seem to be no other characters by which to distinguish them from *angulata*.

17. **Ophiothrix œrstedii** Lutken.

Common throughout the West Indies, in the same situations as the preceding. It is a little larger, 10 to 12 mm. in diameter, and the arms are more slender. Color, usually rich green or blue, the arms transversely striped with white on the upper side. A well-preserved specimen is a handsome object. Specimens in this collection from Puerto Real and from station 6096 have the ground color dark purple, like *angulata*, instead of the usual dark blue or green.

Fifteen specimens were collected at Ponce, Arroyo, Ensenada Honda (Culebra), Caballo Blanco, Mayaguez, and Puerto Real, and stations 6065 and 6096.

18. **Ophiothrix suensonii** Lutken.

One of the handsomest and most notable of West Indian brittle stars, collected at various points southward as far as Brazil, but apparently not so common as the two preceding species. It reaches a large size, up to 14 mm. in diameter, and the arms may be 5 to 6 times as long. Color, pale lavender or bright rose-purple, marked with purple and with a broad longitudinal stripe of purple on the upper side of the arms. The whole structure is very delicate and glassy. Five specimens were obtained, 1 from Boqueron Bay being the most beautiful object in the whole collection. The disk is 14 mm. in diameter, and the arms are 75 mm. long with spines 7.5 mm. The whole structure is very delicate, and the dark longitudinal stripe on the arm is very conspicuous. Of the other specimens 2 are from station 6067 and 2 from station 6079.

19. **Ophiocoma echinata** L. Agassiz.

This large brittle-star is very common from Bermuda and Florida southward to Brazil, occurring under and among rocks and coral along shore and on the reefs. It reaches a diameter of 32 mm., with arms 4 to 5 times as long. The color varies considerably; the disk may be uniform brown or black, or it may be more or less blotched and spotted with gray or white; the arms are usually black. There is also much variation in the size of the arm-spines.

One-fifth of the collection is made up of specimens of this large and very common species. Of the 109, more than half were collected at Ponce and the remainder are from Fajardo, Ensenada Honda (Culebra), Caballo Blanco, and station 6096. Mr. Gray collected a large number of this species at San Juan.

20. **Ophiocoma pumila** Lutken.

Smaller than the preceding, the disk seldom exceeding 15 mm., but found in similar situations throughout the same range. The colors vary somewhat, but the banded arms are very characteristic.

Sixteen small specimens of this species were collected at Ponce and Ensenada Honda (Culebra), and at stations 6076, 6077, 6080, 6095, and 6098. Mr. Gray took one specimen at San Juan.

21. **Ophiocoma riisei** Lutken.

Found with *O. echinata*, from which it is easily distinguished by the rusty-red appearance of the under side of the arms. It is less variable in color, the disk being uniformly black or brown. It has been taken in deeper water, even up to 200 fathoms.

No specimens of this common West Indian species were taken by the *Fish Hawk*, but Mr. Gray collected 4 fine specimens at San Juan.

22. **Ophiopsila fulva** Lyman.

Recorded from various parts of the West Indies in water of from 13 to 175 fathoms depth. Tentacle scales similar to those of the following species. There are 3 specimens of an *Ophiopsila* from station 6067 and 1 from 6080 which are apparently this species, although no one of them agrees perfectly with Lyman's description. The best specimen has the disk gray, with orange spots, as in the type, and 4 oral papillæ and 9 tooth papillæ, but there are only 6 arm-spines, which are flat and narrow, but not acute. The other 3 specimens have 8 or 9 similar but sharper arm-spines, but the tooth-papillæ vary from 5 to 9 and the oral papillæ from 4 to 6; the upper surface of the disk is wanting in all. The upper-arm plates vary from square, with rounded corners, to long, narrow, and rounded in front. Verrill proposes to separate this species from *Ophiopsila* and place it as the type of a new genus, *Amphipsila*, in the family *Ophiacanthidæ*, because of certain differences in the covering of the disk and the arrangement of the tooth papillæ. My specimens of *fulva*, however, agree essentially in these respects with *Ophiopsila riisei*, and the very characteristic appearance and arrangement of the tentacle scales, in which the two species also agree, seem to me too important to be ignored. Judged by the specimens before me, *Ophiopsila fulva* is much more nearly allied to *O. riisei* than to *Amphipsila maculata* Verrill. The latter is clearly not an *Ophiopsila*, and should be considered the type of the new genus. On this point Verrill's papers conflict. In his report on the *Ophiuroidea* of the Bahama expedition (Bull. Univ. Iowa, vol. 1, No. 6, Sept., 1899, p. 55) he says: "*Amphipsila*, gen. nov. Type *A. fulva* (Lym.)." Then follows a characterization of the new genus which will not apply at all to *O. fulva* Lyman. In his other paper (Tran. Conn. Acad., vol. x, pt. 2, Oct., 1899, p. 348) he says: "*Amphipsila* Verrill, 1899*a*, p. 55. Type *A. maculata* Ver." Then follows a copy of his original description of the genus, to which is added the following statement:

"I have separated this genus from *Ophiopsila*, as understood by Lyman, for he included in the latter *A. fulva* (Lym.), which is closely allied to our type species."

This latter statement does not seem to me justifiable, as I have carefully examined Lyman's original description (with which one of my specimens agrees admirably, except in the number of arm-spines), and it does not seem to me that *fulva* Lym. is at all closely allied to *A. maculata* Ver.

All of the 6 specimens of *Ophiopsila* before me agree in having 2 tentacle scales, of which the outer is from one-fourth to one-half the length of the inner. The latter is as long or longer than the arm joint and is generally spatula-shaped, but in 2 specimens is narrower and more pointed. The shape of the upper-arm plates varies greatly, as already mentioned, and the under-arm plates also vary in shape and distinctness. The oral shields also vary from long diamond-shape, longer than broad, to broad shield-shape, much broader than long. There is some slight variation in the number and size of the oral papillæ and tooth papillæ, but in general the specimens agree fairly well.

23. **Ophiopsila riisei** Lutken.

This species occurs throughout the West Indies and south to Brazil in shallow water among rocks or coral. There are 2 tentacle scales, of which the inner is very long and spatula-shaped. One very good specimen of this form from station 6079, and another, much smaller and broken, from 6080. The latter has the disk gray, with black spots, and the upper-arm plates, instead of being almost square, are twice as long as wide and the outer end rounded.

24. **Ophiactis krebsii** Lutken.

This is a common little ophiuran from Bermuda and South Carolina to Rio Janeiro, among corals in shallow water. There are generally 6 arms, 5 to 6 times the diameter of the disk. Oral papillæ usually 2 on a side. There are 6 small ophiurans in the collection, which I have referred to this species. Of these, 4 from Mayaguez reefs and 1 from Playa de Ponce have 6 rays each and the usual green and white coloring; but 1 from station 6080 has only 5 rays, and the colors are pale yellow and brown. In all other respects it agrees with the others. All are small, with disks from 1½ to 4 mm. in diameter.

25. **Ophiactis longibrachia,** nov. sp. (Pl. 14, figs. 1 to 5.)

Rays 5, long and slender. Disk 13 mm. in diameter; arms 100 mm. long; $\therefore r=7\frac{1}{2}d$. Arms 2 mm. wide at base. Disk almost circular, hiding the bases of the arms, covered with small but thickish scales, which are evident only when dry. Over the whole surface of the disk are scattered numerous very small, almost smooth, blunt spines, and these also cover the interbrachial spaces below. Radial shields long and rather narrow, separated at the inner ends, but touching at the outer extremities, smooth and naked. Upper-arm plates granular, wide and short, 3 or 4 times as wide as long, rounded at the sides. Arm-spines 7 (figs. 3 to 5) except on the first few joints the next to the uppermost generally longest, the others regularly shorter to the lowest, which is a little longer than the single large short and blunt tentacle scale. Under-arm plates almost square, with lateral edges markedly raised. Oral shields small, much broader than long, with a blunt angle inward. Adoral plates large, somewhat longer than wide, outer end the wider, meeting each other within. Oral papillæ 1 or 2, at the distal end of mouth slit, above the oral tentacle, separated, somewhat bluntly conical. Genital slits 2 in each interbrachial space. Color above, disk almost black, with outer ends of radial shields and the little spines whitish (under a lens), arms brown, tinged with purple; beneath, disk black, mouth parts and under side of arms at base pale yellowish; outwardly the under side of arms gradually becomes darker, until it is the same shade as above.

The only known specimen of this species was taken at station 6096, off Vieques Island, in 6 fathoms of water, on a coral bottom. It comes near to *O. dispar* of Verrill, which it resembles in some important particulars. It differs from that species in its much larger size, greater length of arms, markedly different color, and size and shape of the adoral plates, while there are slight differences in the arm-spines and oral papillæ and in the scaling of the disk.

The West Indian species of *Ophiactis* need careful revision from a large series of specimens, and when that is done this, as well as *dispar*, may prove to be the adult form of some one of the previously known species. The name given has been selected because of the unusually long arms.

26. **Ophiactis loricata** Lyman.

This uncommon species was originally described from Florida, where it was taken in water from 10 to 110 fathoms deep. The oral papillæ are 2 on each side. There is a single small *Ophiactis* from Mayaguez, which is clearly not *krebsii* and is probably this species. It is very small, with no disk spines, 6 arms with 4 arm-spines, and 2 mouth papillæ. The color is purple and white variegated.

27. Amphiura flexuosa Lyman.

This species was previously known only from Brazil. The Porto Rican specimen was taken at station 6066, on sand and mud, in Mayaguez harbor, at a depth of 162 to 171 fathoms. It answers well to the description, except that the next to the lowest arm-spine is bent.

28. Amphiura stimpsoni Lutken.

This species was known from the West Indies and Brazil in water of 10 to 35 fathoms. The Porto Rican specimen was collected on the reefs at Mayaguez.

29. Amphiura bihamula, nov. sp. (Pl. 14, figs. 6 to 9.)

Arms 5, very long and slender. Disk 5 mm. in diameter, clearly indented in the interbrachial arcs; arms about 60 mm. long; $\therefore R=12d$. Arms scarcely 1 mm. wide at base. Disk covered with rather large smooth scales. Radial shields short and broad, about twice as long as wide, completely separated. Upper-arm plates very broadly oval, rounded in front and wider there than behind; about twice as wide as long. Arm-spines 6 or 7 (figs. 8 to 9), the uppermost shortest; the fourth and fifth, or fifth and sixth, are longest (about equal to the joint) and have 2 prominent little hooks at the tip; all somewhat flattened and minutely spiny. As the distal end of the arm is approached, the upper-arm plates become smaller and the spines fewer, until at the tips the plates are very small, almost circular, and widely separated by the side-arm plates, and there are only 3 spines, subequal and shorter than the joint. Under-arm plates almost square, slightly concave in front, more or less convex behind, becoming longer and narrower as the tip of arm is approached. Tentacle scales, 2 at base of arm, quite small; 1 on the proximal, and 1 on the inner side of tentacle. Beyond the first third of arm there is only 1 scale, the one on inner side of tentacle having disappeared. Oral shields longer than broad, suddenly widened at the proximal end. Adoral plates large, almost triangular, meeting within but not without. Oral papillæ as in typical *Amphiura*, a pair at the tip of the jaw and one rather large one at the distal end. Above and in front of the latter is a small sharp-pointed oral tentacle scale. Genital slits, 2 in each interbrachial space. Color of disk above very light gray; arms and mouth parts very pale cream color.

There is a single very good specimen of this interesting form from station 6050, at entrance to San Juan Harbor, on sand and mud in 91 fathoms. Its nearest allies seem to be *verticillata* Ljn. from Galapagos Islands and *divaricata* Ljn. from the East Indies. Its nearest West Indian ally is apparently *A. otteri* Ljn., but it differs decidedly from that species in the radial shields and in the arm-spines. The name *bihamula* refers to the two little hooks on the lower arm-spines.

30. Amphipholis goesii Ljungman.

Previously known from Cape Hatteras southward to Brazil, in water from 14 to 280 fathoms deep. The Porto Rican specimens were taken on sandy or, more usually, muddy bottom, in comparatively shallow water (4½ to 25 fathoms), but twice at greater depths. It seems to be very common at the west end of Porto Rico. Sixty specimens of this species from stations 6054, 6056, 6057, 6058, 6059, 6060, 6061, 6062, and 6063. The largest has the disk missing, but the arm measures 160 mm. The smallest has the disk only 2½ mm.; the radial shields are scarcely visible, and the oral papillæ are of nearly equal size.

31. Amphipholis limbata (Grube).

This species was previously known only from Rio Janeiro. The Porto Rican specimen, which is a very good one, was taken at station 6053, in 4 to 7½ fathoms of water, on fine sand, in San Juan Harbor.

32. Amphipholis subtilis Ljungman.

This, like the preceding, has been previously known only from Rio Janeiro. The Porto Rican specimens, which are small and badly damaged, were taken at Mayaguez, 2 in shallow water and 1 in 75 fathoms.

33. ? Amphiodia planispina (von Martens).

A single specimen of an amphiuran from station 6065, near Mayaguez, may represent this species, but as the disk is wanting, it is impossible to identify it positively. It is clearly an *Amphiodia*, and has 3 very broad and blunt arm-spines; the color is reddish, while the tentacles are dark brown, making them very conspicuous.

34. **Amphiodia pulchella** (Lyman).

There is a somewhat damaged specimen, probably of this species, which was collected at San Antonio Bridge, San Juan. It agrees with the description of *pulchella*, except that the arm-plates (either dorsal or ventral) are not separated from each other. The species has hitherto been known only from the coast of Florida, in 18 to 39 fathoms.

35. **Amphiodia riisei** (Lutken).

Reported from the West Indies and Brazil, in shallow water. The three Porto Rican specimens were taken in 170 fathoms at station 6066, near Mayaguez.

36. **Amphioplus stearnsii** (Ives).

Previously known only from the Bahamas, in shallow water. The single Porto Rican specimen, which is in good condition, was taken in 97 to 120 fathoms at station 6067, near Mayaguez. The disk is 5 mm. in diameter, the rays 50 mm. long.

37. **Ophionereis dubia** Lyman.

This species is about the same size as *O. reticulata* and is chiefly distinguished by its color. It is found in the Mediterranean and eastern Atlantic. There is one very good specimen of an *Ophionereis* and the ray of another from station 6090, which I have referred, after long hesitation, to this European species. The disk is 6 mm. and the ray 42 mm.; the single arm belonged to an individual nearly twice that size. The color is reddish-brown, the arms banded with darker. The scaling of the disk is very fine. The difference in color between these individuals and *O. reticulata* is very striking, but I could find no difference by which to separate them from *dubia*, though the latter has not been recorded from the West Indies hitherto.

38. **Ophionereis olivacea**, nov. sp. (Pl. 14, figs. 10 to 13.)

Arms 5, rather slender and tapering. Disk about 6 mm. in diameter, almost pentagonal; arms about 33 mm. long; ∴ R=5½*d*. Arms abruptly narrowed where they join disk, but 5 mm. from disk they are 1 mm. wide. Disk covered with numerous small scales, one at the center and a few near the margins being larger than the others. Radial shields narrow, exposed for about one-half millimeter, very widely separated. Upper-arm plates near base of arm small, imperfectly triangular, with rounded corners; farther out they become more diamond-shaped and are longer than broad; at the middle of arm they are broader than long, somewhat 5-sided, with the distal end narrower and rounded; near the tip they become small and almost perfectly hexagonal. Accessory upper-arm plates large and prominent; the first few joints have 2 or more such plates on each side, but farther out there is only 1. Arm-spines 3 (figs. 12, 13), of which the uppermost is blunt and equals the joint; the middle one is nearly twice as long, at least at the middle of arm, and is broadened and rounded at the tip; the lowest is acute and equals the uppermost. Under-arm plates at first almost square, but soon become longer than broad, slightly rounded in front. Tentacle scale 1, very large. Oral shields small, oval, the madrepore plate obviously larger than the others. Adoral plates small, irregularly triangular, pointed and not meeting within; blunt and not meeting without; separating the oral shields from the side-arm plates. Oral papillæ 4 on each side, the outermost decidedly the widest. Above, and largely concealed by the latter, is the pointed oral tentacle scale. Genital slits 2 in each interbrachial space. Color above olive green, spotted on the disk with yellow; arms banded with a darker shade of green; below the color is very light, the interbrachial spaces being pale yellowish marked with olive, while the mouth parts and under side of arms are almost white; outside of oral shield is a patch of dark brown, as in *reticulata*.

The single specimen of this interesting species (from station 6096) differs very markedly from *O. reticulata*, not only in the color (and in this respect *reticulata* is very constant) but in the coarser scaling of the disk, the shape of the upper-arm plates, and in the size and shape of the second arm-spines. The same characters serve to distinguish it from the preceding species, which was taken at a neighboring station. The name selected has been chosen on account of the striking color.

39. **Ophionereis reticulata** (Say).

This handsome ophiuran is very abundant in clean sand in shallow water, especially under stones, from Bermuda and Florida to Rio Janeiro. It reaches a diameter of 12 mm., the arms about 7 times as long. Twenty-one specimens, all small, collected at Ensenada Honda (Culebra), Caballo Blanco, Puerto Real, and Guanica Bay, and at stations 6079, 6080, and 6088.

40. **Ophiostigma isacanthum** (Say).

This small ophiuran (disk 5 to 6 mm., arms 20 to 30 mm.) occurs sparingly from Bermuda to the southern West Indies along shore and in water up to 100 fathoms deep. Its color varies from white to brown, more or less variegated, but is usually very light. The arms are usually 5 but sometimes 6 in number; the latter specimens may be young. There are 4 small specimens, all from station 6079. The smallest has 6 arms and a very small disk.

41. **Ophiacantha bidentata** (Retzius.)

A medium-sized ophiuran, light brown in color, previously known from the North Atlantic. A single small specimen from station 6070 seems to belong to this species.

42. **Ophiacantha ophiactoides**, nov. sp. (Pl. 15, figs. 5 to 8.)

Arms 6, rather short and thick. Disk hexagonal, about 2 mm. in diameter; arms about 8 mm. long; ∴ R=4*d*. Arms about one-half millimeter wide at base. Disk covered with rather coarse scales and bearing a number of small, thorny spinules. Radial shields widely separated and only exposed at the tips. Upper-arm plates broadly oval, becoming triangular at the tip of arm, rounded in front and sharply pointed behind, completely separated by the side-arm plates. Arm-spines 4 (figs. 7, 8), approximately equal and smooth to the eye, but very spiny under a lens, about equaling a joint. Under-arm plates somewhat pentagonal, with rounded corners and an angle directed inward. Tentacle scale 1, small. Oral shields very large, rounded without, bluntly pointed within, much wider than long. Adoral plates long and narrow, wider at the outer end, not meeting without or within. Oral papillæ not very large, smooth, 3 on each side and 2 at tip of jaw, and a large oral tentacle scale at distal end. Genital slits 2 in each interbrachial space. Color, very pale yellowish-green, the arms banded with brown, each band about twice as wide as the intervening space.

One specimen of this curious little ophiuran was taken at station 6076, on coral sand, in 10 fathoms, at Gallardo Bank, Porto Rico. It does not seem to be very nearly allied to any previously known species, but as it is probably immature, it may prove to be the young of some other form. It resembles *Ophiactis krebsii* superficially, especially on the upper surface, and for that reason I have called it *ophiactoides*.

43. **Ophialcæa glabra**, nov. sp. (Pl. 15, figs. 1 to 4.)

Arms 5, rather stout. Disk pentagonal, about 12 mm. in diameter. Arms all broken, 2¼ mm. wide at base. Disk covered with a thick, rather rough skin, which covers a very fine scaling visible only when the specimen is very dry. Radial shields wholly covered, but showing indistinctly through the skin, large and separated. Upper-arm plates broadly in contact, much wider than long, somewhat narrowed proximally, with rather acute outer angles; on one arm they are divided into 2 by an irregular line, perhaps due to an accident. Arm-spines 8 (figs. 3, 4), glassy, flattened, blunt, and slightly rough; approximately equal, about half as long again as the joint. Under-arm plates almost square, slightly convex distally. Tentacle scales 2, very large, about equaling the under-arm plate. Oral shield large, elliptical, much broader than long, touching the first side-arm plate. Adoral plates long and narrow, touching within, wider and widely separated without. Oral papillæ 6 or 7 in a single row, with 1 median tooth papilla; all long, acute, and rather narrow. On the face of the jaw is a little cluster of very small, round knobs. Genital slits prominent, 2 in each interbrachial space. Color, uniform dark brown above; on the interbrachial spaces below are a few scattered spots and blotches of yellowish white; under side of arm and mouth parts whitish.

There is a single specimen of this curious species from Playa de Ponce. Although in the arrangement of the oral papillæ it is a typical *Ophiacantha*, it differs sharply from that genus in the arrangement of the upper-arm plates, the arm-spines, and the covering of the disk. Verrill has recently divided the genus into a dozen sections (Trans. Conn. Acad., vol. x, pt. 2, Oct., 1899) and of these

Ophialcæa comes the nearest to the present species; but even from that genus it differs in the covering of the disk. For the present, however, it may remain in that group, characterized especially by the upper-arm plates being broadly in contact, the rows of arm-spines not approximating dorsally, mouth parts as in typical *Ophiacantha*. This Porto Rican species is nearest to *O. rufescens* Koehl., which was collected in 470 fathoms off the Azores. It differs from that form in the number of arm-spines and in the covering of the disk and radial shields. The name *glabra* is suggested by the very smooth disk, the scales of which are very indistinct.

44. **Ophiopristis hirsuta** (Lyman).

This species occurs throughout the West Indies in water from 80 to 1,000 fathoms deep. It is light chocolate brown above, nearly white beneath, and reaches a diameter of 11 mm. One specimen from station 6070.

45. **Ophioplinthaca spinissima,** nov. sp. (Pl. 15, figs. 9–12.)

Arms 5, stout and very spiny. Disk almost circular, slightly indented in the interbrachial spaces, 7 mm. in diameter. Arms about 30 mm. long; ∴ R=4½ *d*. Arm 1½ mm. wide at base. Disk covered by the radial shields and coarse scales; near the center it is depressed and carries numerous thorny stumps; these also occur elsewhere on the disk, in the interbrachial spaces below and at the distal ends of the radial shields. The latter are very large, about twice as long as wide, and are not simply in contact, but one actually overlaps the other. Upper-arm plates are very widely separated, broadly triangular in outline, slightly curved distally, and 2 or 3 times as wide as long. Arm-spines 9 (figs. 11 and 12), slender, somewhat glassy, very thorny, the fourth longest and about equal to 2 joints; the rows approximate closely dorsally. First under-arm plate almost pentagonal, the point inward; farther out they become hexagonal, the distal side very short, and concave both distally and proximally. Tentacle scale 1, large; sometimes the first one or more are divided into 2. Oral shields wide, much broader than long, narrowest without, wide and rounded within, the madrepore plate much the largest. Adoral plates large, quite broad, four-sided. Tooth papilla 1. Oral papillæ 5 to 7, in a nearly simple row, the most distal ones widest; there may be 1 or 2 narrow papillæ placed distally above these wide ones. Oral tentacle scale conspicuous. Genital slits very prominent, 2 in each interbrachial space. Color very light brown, variegated on disk with darker.

Two specimens of this species were taken at station 6067, in Mayaguez Harbor, on coral bottom, in 97 to 120 fathoms. One is badly broken and much smaller than the one described above. They clearly belong to genus *Ophiomitra* as defined by Lyman, and in some respects resemble the common West Indian species *O. valida*; but the arrangement of the oral papillæ seems to indicate their relationship to Verrill's genus *Ophioplinthaca*, though in some other respects they differ markedly from that genus. They differ from *Ophiomitra* sens. str. in the simple row of oral papillæ and in the close dorsal approximation of the rows of arm-spines, while they differ from *Ophioplinthaca* in the absence of special marginal scales. Were it not for the very close approximation of the rows of arm-spines, they might be considered young individuals of *O. valida;* but considering all their characters, it seems better to regard them as a new species of *Ophioplinthaca*. The name given was suggested by the very spiny arms.

46. **Ophioscolex serratus**, nov. sp. (Pl. 14, figs. 14–17).

Arms 5, flat, slender, and very tapering. Disk almost pentagonal, the sides somewhat conçave, 6 mm. in diameter. Arms about 39 mm. long, ∴ R=6½ *r*. Arms about 1¼ mm. in width at base. Disk covered by a peculiar flaky skin, which extends out on the arms; the surface is roughened by little flakes of a chalky material, between which it appears to be finely granular. Radial shields small, widely separated, showing through this skin, somewhat triangular, the apex pointing outward. Upper-arm plates wanting, the side-arm plates showing through the skin and giving a superficial appearance of upper-arm plates. Arm-spines 3 (figs. 16, 17), flat, very acute, and sharply serrate, the upper one longest, about equal to a joint and lying flat against the arm. Under-arm plates squarish, with truncated corners, slightly concave distally. Tentacle scales wanting. Oral shields twice as wide as long, the outer side almost straight, the inner widely curved. Adoral plates narrow, about equally wide at the two ends, meeting within, but not without. Oral papillæ 9, of which 1 is at the apex of the jaw; they are flat, thin, and abruptly pointed. Teeth large, rounded, prominent. Genital slits prominent, 2 in each interbrachial space. Color of disk (speckled with the whitish flakes above) greenish-yellow; upper side of arms bright yellow; beneath very pale, almost white.

There is a single specimen of this new species, collected at station 6050, at the entrance to San Juan Harbor, in 91 fathoms. In the number of oral papillæ and the absence of tentacle scales it approaches *O. glacialis* Müller & Troschel, but it differs from that form in the shape of the oral papillæ, and from all previously known members of the genus in the serrate arm-spines and the large rounded teeth. The name *serratus* has been selected on account of the arm-spines.

47. **Ophiomyxa flaccida** Lutken.

This large, handsome, and very active species is known from Bermuda to Brazil. It is found under and among rocks and coral in shallow water. The color varies greatly, from uniform tawny or reddish yellow to green marked with white. A single large specimen in the *Fish Hawk* collection is from Ensenada Honda (Culebra), and Mr. Gray has a large specimen in his collection from San Juan.

48. **Astroporpa annulata** Oerstedt & Lutken.

This very handsome and curious ophiuran is known from many West Indian stations, where it occurs at depths of from 20 to 163 fathoms, and it has also been taken off Cape Hatteras and Chesapeake Bay. The arms measure upward of 100 mm. in length. There is a single specimen in the Porto Rican collection from station 6063.

49. **Astroschema oligactes** Lutken.

Known from various stations in the West Indies at depths of 69 to 288 fathoms, among corals. The arms are from 100 to 150 mm. in length. There is a single specimen before me from station 6067.

While there are more than 100 other species of brittle-stars known from the West Indies, most of them are deep-water forms and very few are likely to be met with in shallow water. There are, however, a few species not given in the above list which will probably be found along shore in Porto Rico, as they have been in other islands of the West Indies. One is a species of *Ophiura* (*guttata* Lyman), allied to *brevicauda* and found in similar situations. In it the upper-arm plates are broken into numerous pieces; the disk is about 15 mm. in diameter; above dark brown, beneath bright yellow. Another species found in similar situations is *Ophiolepis paucispina* Müller & Troschel, allied to *O. elegans*, but easily distinguished by having only 2 arm-spines. Other species of *Ophiactis* may occur, but their identification is a matter of great difficulty and can only be accomplished with the aid of figures or elaborate descriptions. *Amphipholis gracillima* (Stimpson) may occur and is easily distinguished from other members of the genus by having 4 to 5 arm-spines.

Over 40 years ago *Ophioblenna antillensis* was described by Lutken from 2 specimens labeled simply "West Indies" and presumably taken in shallow water. The species has not been met with since, and its rediscovery would be of great interest. It is characterized by the disk being covered with a naked skin, numerous close-set, spine-like oral papillæ, and 6 to 7 flat, pointed, glassy, slightly thorny arm-spines.

It is not a little strange that the *Fish Hawk* did not collect a single specimen of the ophiurans known as "basket-fish," as several species belonging to the genera *Astrophyton* and *Gorgonocephalus* are known from the shallow water of the West Indies, though seldom near low-water mark. They are characterized by the arms being dichotomously branched into numerous branchlets, capable of being vertically coiled. When taken from the water, the arms bend and curl inward toward the mouth and become more or less interwoven, thus giving rise to the curious shape from which the name "basket-fish" has arisen. They reach a large size, the disk 50 mm. or more across, and the whole "basket" being often over a foot in diameter. The color is usually yellowish or reddish brown.

ECHINOIDEA.

SEA-URCHINS, SEA-EGGS, SAND-DOLLARS, SEA-MOONS, ETC.

The collections made by the *Fish Hawk* contain over 300 specimens of echinoids, but about two-thirds of these represent two species, and half of the remainder are supplied by two other common forms. There are 13 species altogether, and all of them are well known from the West Indies. Nine of the 13 are distinctly littoral forms, but 3 of the others occur only at depths of over 60 fathoms. The remaining species, *Brissopsis lyrifera*, is given by Agassiz (Revision of the Echini, p. 369) as occurring at depths of from 55 to 115 fathoms, so that it is worthy of special note that the *Fish Hawk* collected three adult specimens in Mayaguez Harbor in only 7 fathoms of water.

The following artificial key will enable anyone to distinguish these species from each other, but is liable to prove untrustworthy for young or very small specimens and worse than useless where other species are concerned.

A. Test hard, hemispherical, elliptical, or more or less globular, the height equaling or exceeding one-half the diameter. Mouth at center of lower surface. (Sea-urchins proper.)

- I. Test approximately as wide as long.
  - *a.* Spines stout and more or less club-shaped, longer than one-half the diameter of test.
    - 1. Spines not more than equaling diameter of test .... *Cidaris tribuloides.* (1)
    - 2. Spines usually much exceeding diameter of test, often nearly or quite twice as much. *Dorocidaris papillata.* (2)
  - *b.* Spines very long and slender (2 or 3 times the diameter of test) with needle-like points... *Diadema setosum.* (4)
  - *c.* Spines short, rather slender and pointed, not nearly equaling diameter of test.
    - 1. Spines all white or whitish; test brownish or purplish .... *Hipponoë esculenta.* (8)
    - 2. Some of the spines green or greenish, and often with more or less red or violet; test usually with a decidedly greenish tinge .... *Toxopneustes variegatus.* (7)
- II. Test not as wide as long; usually the difference in the two diameters is very marked.
  - *a.* Apex of test, around anus, covered with numerous small spines.......... *Echinometra subangularis.* (5)
  - *b.* Test about anus almost wholly free from spines.......... *Echinometra viridis.* (6)

B. Test soft and leathery; more or less globular in life; very flat in dead specimens. Deep-water forms. (Flexible sea-urchins.)

- I. Color purple above; light yellowish about the mouth.......... *Asthenosoma hystrix.* (3)

C. Test hard, much flattened, circular or elliptical, the height not one-half of diameter; mouth at center of lower surface; spines very short and numerous. (Sand-dollars, key-hole urchins, sea-moons, etc.)

- I. Oral surface very concave; test accordingly highly arched.......... *Echinanthus rosaceus.* (9)
- II. Oral surface flat; test not arched, very thin.
  - *a.* Test with six slits (lunules) through it.......... *Mellita sexforis.* (10)
  - *b.* Test with only five lunules .... *Mellita testudinata.* (11)

D. Test hard, oval or elliptical; mouth near anterior end on the flattened oral surface; spines compatatively short and numerous with or without scattered, long ones. (Spatangoids.)

- I Size large (over 100 mm.); color deep reddish-purple.......... *Palæopneustes hystrix.* (13)
- II. Size small (60 mm. or less); color light brown .... *Brissopsis lyrifera.* (12)

1. Cidaris tribuloides (Lamarck).

This urchin is marbled light brown and white, often with some red, especially on the spines. The large spines are comparatively few in number. The test of full-grown specimens is about 60 mm. in diameter. This species occurs abundantly in shallow water from South Carolina to Brazil, especially about reefs. A large number of specimens were collected at Arroyo and Mayaguez, and at stations 6075, 6087, and 6096. The largest was 58 mm. in diameter, with spines 45 mm. long.

2. Dorocidaris papillata (Leske).

This species resembles the preceding in size and color, but is usually lighter and the spines are often almost white; they are also more slender and tapering than in *Cidaris*. It occurs only in water of considerable depth, and is found on both sides of the North Atlantic, from Norway to the Mediterranean, and throughout the West Indies. Two specimens, one from station 6067, 23 mm. in diameter, with spines 53 mm. long, and one from station 6070, 45 mm. in diameter, with spines 83 mm. long.

3. **Asthenosoma hystrix** (W. Thomson).

As this urchin occurs only in deep water, it is not likely to be met with by the ordinary collector. It reaches a large size (140 mm. in diameter), but the test is always soft and flexible. The spines are short but very sharp, and scattered rather sparsely over the test. The feet are in three vertical rows in each poriferous zone in the adult.

There are two large specimens of this very curious flexible urchin, both as flat as can be. They measure 135 and 140 mm. in diameter, but are only 7 mm. thick. The abactinal surface is purple and the actinal very pale yellow. These specimens were collected at station 6070, and from the same place there are two very small flexible urchins, 10 mm. in diameter, which I refer with some hesitation to this species. Their coloration is precisely like that of the large ones, but the feet are in only a single row in each poriferous zone instead of in three rows, as in the adult.

4. **Diadema setosum** Gray.

One of the most characteristic urchins of the Tropics; of world-wide distribution from Cuba eastward to the Fiji Islands. Almost black, but the spines are often banded with white in the young. The adults are sometimes 100 mm. in diameter, with spines 300 or 400 mm. long. Very common about coral reefs.

The *Fish Hawk* collection contains twenty specimens of this species, varying from 17 to 75 mm. in diameter, and collected at Ponce, Mayaguez, and Arroyo. The smallest (those less than 40 mm. in diameter) usually have the spines banded light and dark, whitish or yellowish, alternating with purplish or brownish. One large specimen has all the spines on the actinal surface white. A large specimen from Ponce differs markedly from all the others in that a number of the spines, especially on the actinal surface, have prominent swollen "rings," 6 to 10 mm. wide and 2 to 3 mm. in diameter, about 25 mm. from the base. As all the spines are broken, I am not sure whether this swelling is always at the tip of the spine or not, but it appears as though it was. The spines are horizontally ringed, but these swellings are longitudinally ridged.

5. **Echinometra subangularis** (Leske).

This species is often called the "rock-boring" urchin, because of its habit of living in cavities in the reefs and ledges in shallow water. In size it is rather small, not often 50 mm. long, the spines about 20 mm. It varies greatly in form and proportions, but especially in color. All stages from very pale reddish brown to nearly black are common, while the spines are often green with more or less violet. It is found from Bermuda to Rio Janeiro. The collection contains 105 examples, exhibiting a most extraordinary range in color and shape. Indeed, the extremes are so different one might easily believe there are at least two distinct species in the series. The more common form was collected at Ponce, Arroyo, Boqueron Bay, Fajardo, San Juan, and Aguadilla. The largest measures 42 mm. long by 38 wide by 22 high. The spines are slender, 20 mm. long, and less than 2 mm. in diameter. The color varies from bright light green with violet-tipped spines to very light reddish brown and thence through varying shades of red-brown to almost black. The other form was collected at Ensenada Honda and on the light-house reef at Playa de Ponce. The difference in size is not notable, but the test is somewhat more flattened. The spines, however, are very different. They measure from 15 to 20 mm. in length and from 2 to 3½ mm. in diameter. They are much stouter, therefore, and are also somewhat flattened and abruptly pointed. Their color varies from pale, dull pink, through reddish brown to dark green, the spines having violet tips; in some more than half the spine is violet.

6. **Echinometra viridis** A. Agassiz.

This species closely resembles the preceding in size, shape, color, and habits, and seems to be distinguished only by the bare apical system. It is recorded from Florida, Cuba, and Haiti. Two specimens from the reefs at Playa de Ponce seem to be referable to this species. They are of about average size and color. The test is brownish; spines light green, almost yellow at base, violet tipped. There are no spines within the anal area, and only about 12 to 15 in the whole abactinal system.

7. **Toxopneustes variegatus** (Lamarck).

The common sea-urchin of the tropical western Atlantic, abundant from Bermuda and North Carolina to Rio Janeiro. It varies greatly in color from rich violet (Bermuda) to bright green and white (Jamaica). Like the following species, it is usually found on sandy bottom and often covers itself with bits of seaweed and other débris. The collection contains 28 specimens, the smallest of which is only 4 mm. in diameter. They were collected at Ponce, Arroyo, Boqueron Bay, San Juan, Cataño, and Hucares. The color varies considerably, but is usually green and white. The spines are often tipped with reddish, and the specimen from Hucares has the spines rose pink.

8. **Hipponoë esculenta** (Leske).

A very large urchin, sometimes 150 mm. in diameter. Adults are easily recognized by their white color and great size, but the young are not readily distinguished from those of the preceding species. Occurs from Bermuda to Surinam. The eggs are sometimes used for food. From Porto Rico there are fifteen of these large urchins, besides several fragments. Several of them measure 140 mm. in diameter and 95 mm. high, while the smallest is only 19 mm. in diameter. They were collected at Ponce, Arroyo, Aguadilla, and Guanica Bay.

9. **Echinanthus rosaceus** (Linnæus).

In life this species is reddish, yellowish, or greenish brown in color. It reaches a length of 140 mm., and the height is from one-third to nearly one-half the length. It occurs in the sand, often under stones and in very shallow water, and is found from South Carolina to Guadeloupe. Only one example of this species in the collection, a fair-sized specimen from Fajardo.

10. **Mellita sexforis** (Lamarck).

This very flat and thin "keyhole urchin" is usually light olive-green (rarely brown) when alive. It reaches a diameter of 70 or 80 mm., and is found on sandy bottoms in shallow water, from South Carolina and Bermuda southward throughout the West Indies. One large specimen, 74 by 72 mm., from Arroyo, and four smaller ones from station 6085. The color of all these is pale olive-green.

11. **Mellita testudinata** Klein.

This "keyhole urchin" is slightly larger and thicker than the preceding, but of the same color and habits. It has a wider range, having been found from Nantucket to Brazil. The *Fish Hawk* collection contains 10 specimens, varying in size from one 3 mm. in diameter to one 80 mm. broad by 70 mm. long. The color varies from light to dark green. The specimens less than 12 mm. in diameter show very nicely the formation of the lunules. In the smallest specimen no lunules are visible from above, but on the oral surface, in the posterior interambulacrum, there is a little depression which marks the position of the first lunule. The specimen 12 mm. in diameter has this lunule fully formed, while the other four lunules appear simply as notches in the edge of the test. Found at Ponce, Arroyo, Mayaguez, Puerto Real, and station 6053.

12. **Brissopsis lyrifera** Agassiz.

This spatangoid is usually found only in deep water, rarely in less than 10 fathoms. It can not be confused with the following. It is found not only throughout the West Indies, but in the eastern Atlantic also, from Norway to the Mediterranean. There are 3 specimens of this form from station 6059, the largest of which measures 40 by 33 mm. The color is light yellowish brown. The fasciole connecting the subanal with the peripetalous fasciole is not complete and is only distinct close to the subanal. These specimens thus resemble European examples of the species more closely than they do those from Florida.

13. **Palæopneustes hystrix** A. Agassiz.

This rare form, occurring only in deep water, is not likely to be met with. Its size (125 by 90 mm.) and color are sufficient to distinguish it from the preceding species, but an additional character is to be found in the broad, spatulate ends of the long spines. It is known only from the Caribbean Sea.

Of this remarkable spatangoid the collection contains one whole specimen, half of a second, and fragments of others, all from station 6070. The specimens measure about 125 mm. long by 90 broad by 55 high; color dark purplish red; spines somewhat lighter.

Besides the foregoing thirteen species, several other common West Indian echinoids may be expected to occur along the shores of Porto Rico. These are *Clypeaster subdepressus* (Gray), *Encope emarginata* (Gmelin), *Encope michelini* Agassiz, *Echinoneus semilunaris* (Gmelin), *Brissus unicolor* Klein, *Meoma ventricosa* (Lamarck), *Metalia pectoralis* (Lamarck), and *Moira atropos* (Lamarck). The first four will fall under the heading C in the key on page 252, the last four under the heading D. *Clypeaster* resembles *Echinanthus*, but may be easily distinguished by its larger, much flatter test. It occurs from South Carolina to Brazil and eastward across the Atlantic. The two *Encopes* resemble *Mellita*, but are larger (up to 140 mm. in diameter), and the lunules are different. Those in the radii differ from the one in the posterior interradius and are inclined to be elliptical or even oval. The two species of *Encope* may be distinguished from each other by the fact that in *emarginata* the posterior lunule is longer than any of the others, while in *michelini* it is generally smaller than the others. In the latter species, moreover, the anterior lunules often disappear with the growth of the animal, so that the test has only one or three lunules left. *Encope emarginata* occurs from South Carolina to Brazil, while *michelini* is found throughout the Gulf of Mexico.

Echinoneus is quite different from any of the others. Although properly a spatangoid, the mouth is central, so that in the key on p. 252 it would come under C rather than D. The test is a somewhat flattened ellipse, from 15 to 40 mm. long, covered with short, light-brown spines, and with the bright-red feet (in living animal) arranged in five double rows, radiating from the center of the aboral side. It lives in the sand in shallow water, often under stones, and occurs throughout the West Indies. It has been recorded in the past from Porto Rico.

Brissus unicolor resembles *Brissopsis lyrifera*, but may be distinguished from that species by the position of the center of the ambulacral system. In *Brissopsis* this point is near the center of the test; in *Brissus* it is far forward. Moreover, *Brissopsis* is a deep-water form occurring only occasionally in a few fathoms, while *Brissus* is found in very shallow water, in the sand, often under stones, in company with *Echinoneus*. *Brissus* has a wide distribution, being found all through the West Indies and eastward across the Atlantic into the Mediterranean.

Meoma and *Metalia* are both very large spatangoids (up to 200 mm. or more in length) and occur in comparatively shallow water, 1 or 2 fathoms. *Metalia* is much more flattened; the ambulacra are very slightly sunken, and the spines, especially on the upper side, are very coarse. *Metalia* is brown; *Meoma* varies from light-yellowish to deep-reddish brown. Both occur throughout the West Indies.

Moira atropos is easily distinguished from all the preceding by the very deeply sunken ambulacra, which give the test almost a deformed appearance. It reaches a length of 50 mm., and the color is yellowish brown. It occurs southward from South Carolina into the West Indies and Gulf of Mexico.

Owing to the firm structure of the test, all echinoids (except the flexible sea-urchins) can stand the wearing of water for some time after the death of the animal. In such cases the spines drop off and the organic matter is washed out, leaving the tests as delicate white or dull-colored shells, more or less granular, according to the size of the spines with which they were covered. These shells are sometimes called "sea eggs." Such tests are often of value to the zoologist, and should be preserved. Usually they are sufficient for the determination of the species to which they belonged.

HOLOTHURIOIDEA.

HOLOTHURIANS, SEA-CUCUMBERS, SEA-SQUIRTS, ETC.

The holothurians of the West Indies are not nearly so well known as the sea-urchins, so that every new collection is likely to contain undescribed species, or at least to extend the range of those previously known. About 35 species have been described from the West Indian region, or are known to occur there, and of these less than half a dozen are exclusively deep-water forms. It appears, therefore, that the great majority of the holothurians of this region are littoral forms, and many of them are apparently quite limited in their range. But as yet we know too little of their natural history, or of what constitute good specific characters in the group, to draw any important conclusions. Species have been made on form, color, size, number of tentacles, and other inconstant characters to such an extent that the whole subject of West Indian holothurians needs a thorough overhauling, especially since they constitute one of the most characteristic groups of the shallow-water fauna.

The *Fish Hawk* collection contains 85 specimens of sea-cucumbers, representing 10 species, all but one of which are littoral forms. Curiously enough, all these littoral forms belong to the single family *Aspidochirotæ*, so that probably only a small part of the holothurian fauna of Porto Rico appears in the collection.

The following artificial key will help to distinguish adult specimens of the above given species, and also includes one other species collected by Mr. Gray. It is hard to give distinguishing characters among holothurians, except by means of the microscopic calcareous particles in the skin. As far as possible the characters used below can be easily seen without the aid of a microscope; but it must be remembered that the number and arrangement of the tentacles, pedicels, and papillæ are often very different in the young from what they are in the adult. They are usually fewer in number and show a more orderly and definite arrangement.

A. Tentacles long, slender, unbranched. Body-wall firm and spiny. Color white. Deep-sea form. *Echinocucumis asperrima.* (1)

B. Tentacles (normally 20) comparatively short, with numerous branches, crowded into a flat disk at the end. Body-covering soft. Shallow-water forms.

- I. Size large, up to a foot or more in length. Found on sandy or muddy bottom.
  - *a.* Brown or black above; yellowish, reddish, or almost white below, and more or less on sides. Body-wall tough and leathery. Pedicels numerous on ventral side, not arranged in rows .... *Holothuria mexicana.* (8)
  - *b.* Color extremely variable; the extremes are uniform blackish-brown, without markings, and uniform light buff with a few small spots of dark brown. Between these two extremes all possible combinations of light and dark occur, but the commonest form is buff, considerably blotched with large patches of dark brown. Body-wall, though thick, soft and slimy. Pedicels numerous, arranged distinctly in three broad longitudinal rows on ventral surface.......... *Stichopus möbii.* (2)
- II. Size small, rarely 8 inches long. Usually found among rocks, often buried in sand under loose slabs.
  - *a.* Body covered with more or less wart-like conical papillæ. Pedicels few, irregularly scattered, or none .... *Holothuria impatiens.* (7)
  - *b.* Pedicels arranged in 3 longitudinal series on ventral surface. Cuvier's organs very noticeable, pure white in living animal .... *Holothuria captiva.* (3)
  - *c.* Pedicels thickly crowded ventrally, less numerous dorsally; few papillæ, if any...... *Holothuria glaberrima.* (5)
  - *d.* Body very thickly covered with pedicels ventrally and with papillæ and pedicels dorsally. *Holothuria densipedes.* (4)
  - *e.* Body elongated, with scattered and rather few papillæ on dorsal surface, and irregularly scattered pedicels on ventral.
    1. Blackish and whitish or light gray, mottled with darker; sometimes more or less tinged with yellow.......... *Holothuria grisea.* (6)
    2. Grayish, but more or less decidedly yellow, with fine purple markings and blotches of the same color.......... *Holothuria rathbuni.* (9)
    3. Brownish or purplish, more or less indistinctly marked with darker blotches.. *Holothuria surinamensis.* (10)

C. Tentacles 15, pinnate. Body long and slender, without pedicels .... *Synapta lappa.* (11)

1. **Echinocucumis asperrima** Theél. (Pl. 16, figs. 1-7.)

This extraordinary holothurian is 1 or 2 inches long, including the long neck and slender, tapering tail. It has been recorded from only the Caribbean Sea, and there only in deep water.

There is one specimen of this species dredged at station 6066, in 170 fathoms of water. It is just 24 mm. long, and the delicacy and glassiness of its appearance make it an object of unusual interest. The species was first described by Theél, in 1886, from specimens collected in the vicinity of Jamaica and Cuba, at depths of 150 fathoms or over. As he published no figures of the species, it seems worth while to give with this report some illustrations of such a noteworthy form. The tentacles (fig. 4) are apparently only eight in number, and differ from the tentacles of all other pedate holothurians in being perfectly simple, without branches of any kind. The calcareous ring (fig. 2) is very small; no stone canal or Polian vessel found. Genital filaments few, but thick. Respiratory trees very delicate. No Cuvier's organs. Respiratory trees and intestine with numerous brownish spherical bodies in their walls, possibly waste matter. Intestine very long and much coiled. Pedicels very scarce, almost wanting, except near head and tail. Body-wall (fig. 3) very hard and firm, as though mailed, pure white. It is composed of more or less regular polygonal plates, each of which bears a single, long, stout and sharp spine. Calcareous bodies (figs. 6 and 7) consisting of irregular plates with numerous holes, very abundant, especially in and near the tentacles.

2. **Stichopus mœbii** Semper.

A common species and very interesting on account of the great variety in the color, shape, appearance, and number of tentacles. It reaches a length of 300 mm. or so. The body-wall contains numerous tables and C-shaped bodies; the former with well-developed disk and numerous teeth at top. Known from Bermuda and the West Indies. There are 8 specimens of *Stichopus* in the *Fish Hawk* collection, varying in size from 90 to 220 mm. Though differing somewhat in color, they all show the light background with large dark spots and blotches. The number of tentacles varies from 16 to 20, there being 1 with 16, 1 with 17, 2 with 18, 1 with 19, and 3 with 20. It is worthy of note that the two largest specimens have 20 tentacles and the two smallest have 18 and 16, respectively. This species was collected at Boqueron Bay, San Juan, and Mayaguez, and these specimens agree in all essentials with those from Jamaica and Bermuda.

3. **Holothuria captiva** Ludwig.

This little holothurian rarely reaches a length of 100 mm. It is rich brown in color, somewhat paler below. On the back are rather numerous papillæ. The body-wall contains numerous tables, with many teeth at the apex, and buttons with 3 pairs of holes. The species is known only from Bermuda and the West Indies. There are only two specimens from Porto Rico, and both are very small, 12 and 15 mm. in length. They were collected at Hucares. The skin is very delicate, almost without pigment, but the deposits are numerous, full size, and perfectly formed. Color in alcohol dirty-brown. Cuvier's organs very noticeable; in one specimen their bulk is fully one-tenth of the whole animal.

The arrangement of pedicels, papillæ, and tentacles is of interest.

Specimens.	Pedicels.	Papillæ.	Tentacles.
Smaller specimen	15 in a row; a single row on each side, a double row in middle of ventral surface.	Six longitudinal rows with 6 papillæ in a row.	10
Larger specimen	18 in a row; rows as above.....	Six rows with 10 in a row ..	14

4. **Holothuria densipedes**, nov. sp. (Pl. 17, fig. 1.)

There is a single specimen, from the light-house reef at Playa de Ponce, of a holothurian unlike any yet described. On account of the very numerous and crowded pedicels, I have given to it the name *densipedes*. It is 88 mm. long and about 20 mm. in diameter. The color is brown, with a few scattered dull purple or blackish blotches. The papillæ have a reddish tinge, while the pedicels are much lighter, with a touch of yellow. The pedicels are crowded on the ventral surface, and are numerous, though somewhat smaller, dorsally. The papillæ are numerous and confined to the dorsal surface. There is no sign of arrangement in rows of either the pedicels or papillæ. Tentacles very small and pale, apparently 20. Polian vessel 1. Stone canal 1. Water-ring with many small bead-like bodies on it. Cuvier's organs present; small, greenish. Genital glands with numerous infrequently branched filaments. The calcareous deposits consist of tables and smooth buttons, with numerous supporting rods in pedicels, papillæ, and tentacles. The buttons usually have three pairs of holes, but not infrequently there are only 3 or 4 holes. The tables have the disk with 4 large central holes or a single deeply 4-lobed hole, surrounded by a circle of smaller holes, 4 larger alternating with 4 smaller, to complete the circle. The spire is comparatively low, with only 1 crossbeam and few (not more than 10 or 12) teeth. The tables of the pedicels are usually much reduced.

The supporting rods of the tentacles are simple, slightly rough or knobbed at ends. Those from the pedicels are usually broader and pierced by holes more or less symmetrically arranged. There are often 7 or 8 pairs of these holes. The calcareous ring is composed of 5 large radial pieces and 5 small, narrow, pointed interradial plates. The calcareous ring and the various calcareous deposits are exactly like those of *H. rathbuni* Lampert, from which species this form is otherwise radically different. (See pl. 17.) It differs from its nearest allies in the crowded papillæ on the dorsal surface, as well as in the detailed structure of the tables, while it differs markedly from *H. glaberrima* in the large size of the pedicels and papillæ, and in their crowded arrangement. It is known as yet only from Porto Rico.

5. Holothuria glaberrima Selenka.

Especially common in cavities in coral rocks on the reefs and along shore. It is rather short and stout, seldom more than 100 mm. long. The color varies greatly from pale yellowish brown to almost black, but is generally uniform over the body. The body-wall contains only scattered branching rods. It is found throughout the Caribbean Sea and Gulf of Mexico. Six specimens from Hucares vary in length from 65 to 110 mm. In five the color is blackish brown, the tentacles black; the sixth is light yellowish brown, with light tentacles.

6. Holothuria grisea Selenka

This species reaches a length of 150 to 200 mm. The body-wall contains tables and small forked rods, the latter gathered in little circles or spots, often visible to the naked eye. It has been recorded from the West Indies, Surinam, and Brazil. Two specimens from Arroyo, 50 and 110 mm. long, and one from Hucares 70 mm.

7. Holothuria impatiens Forskal.

This is one of the most widely distributed of holothurians, being known from the warmer seas of all parts of the world. It reaches a length of 150 to 200 mm., and is grayish purple in color, sometimes blotched with darker. Tentacles often very light colored. The body-wall contains tables and buttons with 3 pairs of holes. From Culebra there is one typical specimen 85 mm. long, and from Ponce there are two specimens 110 to 125 mm., which are dark gray in color with no trace of purple.

8. Holothuria mexicana Ludwig.

This is one of the largest West Indian holothurians, often reaching a length of 450 mm. or more. The color varies greatly; some specimens, usually small ones, are light brown above and pink or flesh-color beneath, the pedicels brown; others are almost jet-black with scarcely any light below. Between these two extremes all sorts of intergradations occur. The thick, leathery body-wall, which contains simple tables and numerous perforated plates of two kinds, helps greatly to distinguish this species. Described first from the Gulf of Mexico, and known only from the West Indian region.

Of this very common species, there are some 20 specimens in the collection, from 110 to 300 mm. in length. There is great diversity in the number of tentacles and Polian vessels. Four individuals have 18 tentacles; six have 19; nine have 20; one has 21. Two individuals have 1 Polian vessel each; two have 2; five have 3; two have 4; three have 7; one has 8; one has 9. These specimens were collected at Culebra, Fajardo, Boqueron Bay, Guanica, Puerto Real, Mayaguez, and San Juan.

9. **Holothuria rathbuni** Lampert. (Pl. 17, figs. 2 to 10.)

This species reaches a length of 200 mm. The body-wall contains tables and buttons with three pairs of holes. Occurs from Bermuda to Brazil.

There is a small holothurian in the collection from Culebra, which I have finally decided to consider a young specimen of this species. *H. rathbuni* was first described by Mr. Richard Rathbun from specimens collected at Rio Janeiro, but he gave no name to it. In 1885 Lampert, without any further information, gave the species the name *rathbuni*. Among holothurians which I collected in Jamaica in 1896 and 1897, there are numerous specimens which may be referred without doubt to Mr. Rathbun's species. In 1899 the New York University party collected similar specimens on the south shore of the Bermuda Islands. These specimens all agree in coloration, size, and calcareous parts, as well as in habits, with the specimens from Brazil, as described by Mr. Rathbun. The Porto Rican specimen before me is only 50 mm. long, and is rather spindle-shaped, tapering towards both ends. The pedicels are confined to the ambulacra, where they form five double rows, which are very distinct near the two ends, but rather indistinct at the middle. Tentacles 20 in number, small and pale. Color light gray with a decidedly yellow tinge ventrally, more or less distinctly marked on the interambulacra with purplish black. Cuvier's organs are present, dirty green in color. There is no genital gland, which adds strength to the opinion that this is a young individual. It differs from adults in the arrangement of the pedicels, which are in them irregularly scattered. As no figures have ever been published of the calcareous parts of *H. rathbuni*, it seems wise to give them in connection with this individual.

10. **Holothuria surinamensis** Ludwig.

This very common species reaches a length of about 150 mm. The body-wall is often very thin. It contains a few irregular rods and numerous imperfect tables which lack the disk. Occurs from Bermuda southward to Surinam and into the Gulf of Mexico. About half of the holothurians collected by the *Fish Hawk* consist of this species, of which there are 40 specimens, 30 to 140 mm. in length, from Ponce, Boqueron Bay, San Juan, Puerto Real, and Guanica. In some the "bars" in the skin are numerous and very noticeable and the tables are heavy, while in others the "bars" are rather infrequent and the tables more delicate.

11. **Synapta lappa** Müller.

This large synapta reaches a length of 600 mm., or even more. The color varies considerably, from light gray to dark brown. The body-wall is thin and contains numerous "anchors and plates" (characteristic of the genus) and great quantities of miliary granules. It is found under rocks on sandy bottom in shallow water throughout the West Indies. Mr. Gray's collection contains a single specimen, found under a rock near San Juan.

Besides the species with the "shield-shaped" tentacles, there will doubtless be found along the shores of Porto Rico representatives of another family of holothurians, the *Dendrochirotæ*. Of this family *Cucumaria punctata* Ludwig and species of *Thyone* are almost sure to occur. Of the *Synaptidæ*, besides *Synapta lappa* Müller, *Synapta vivipara* (Œrstedt) and *Chiridota rotifera* Pourtales will very probably be collected. Moreover, another genus of the *Aspidochirotæ* (of which *Holothuria* is a typical genus), *Mülleria*, may occur. This latter genus can be easily recognized by the five prominent calcareous teeth in the anus. It is brown, mottled with darker and lighter shades, and reaches a length of 300 mm., or thereabouts. *M. agassizii* Selenka, with 25 to 30 tentacles, has been collected in Florida, Haiti, the Tortugas, Bimini, and Jamaica. *Cucumaria punctata*, which reaches a length of 70 or 80 mm., may be recognized by the 10 much-branched dendriform tentacles, the bluish-gray color, and the yellowish pedicels, which occur in double rows along the ambulacra but are also somewhat scattered on the rest of the body. It occurs in cavities within and underneath broken rocks, from Bermuda to Barbados. *Thyone* is a genus similar to *Cucumaria*, but has the pedicels much more numerous and crowded irregularly all over the body.

The members of the *Synaptidæ* may be easily distinguished from all other holothurians by the absence of pedicels, papillæ, and respiratory "trees." The tentacles are pinnate and the body is more or less translucent. *Synapta vivipara* is a small species, 20 to 100 mm. long, reddish or greenish brown in color with more or fewer white spots. It is found living in seaweeds from Bermuda to Brazil. *Chiridota rotifera* is also a small species, rarely 100 mm. long, flesh-colored with little white spots, found under stones in the sand. The body-wall contains characteristic wheel-shaped bodies. It has been collected from Bermuda, Florida, Jamaica, and Brazil.

DISTRIBUTION OF SPECIES.

Of the 50 stations where the *Fish Hawk* dredged, trawled, or used the tangle, 36 yielded echinoderms. Their distribution is shown in the following tables and statements. The first table treats of the west end of the island, the stations being given as nearly as possible in their geographical order. The Crinoidea and Holothurioidea are given outside of the tables for typographical convenience.

Only two representatives of Crinoidea were found in this part of the island:

Actinometra meridionalis, at station 6063, depth 75 to 76 fathoms; bottom of rocks, sand and coral; obtained with 11-foot trawl.

Antedon hageni, at station 6067, depth 97 to 120 fathoms, coral bottom; obtained with dredge.

Specimens of the Holothurioidea were found as follows:

Holothuria mexicana, at Mayaguez, Puerto Real, and Boqueron Bay.
Holothuria surinamensis, at Puerto Real and Boqueron Bay.
Stichopus mobii, at Mayaguez and Boqueron Bay.
Echinocucumis asperrima, at station 6066, 97 to 120 fms., coral bottom, a dredge being used.

Asteroidea, Ophiuroidea, and Echinoidea collected by the Fish Hawk at the western end of Porto Rico.

Station.	Depth, bottom, and apparatus.	Asteroidea.	Ophiuroidea.	Echinoidea.
Aguadilla				Echinometra subangularis. Hipponoë esculenta.
Station 6055	137 fms.; sand, mud, and shells; dredge.		Amphipholis goesii.	
Mayaguez		Astropecten antillensis. Luidia senegalensis. Pentaceros reticulatus.	Amphipholis subtilis. Amphiura stimpsoni. Ophiactis krebsii. loricata?. Ophiothrix angulata. œrstedii.	Cidaris tribuloides. Diadema setosum. Hipponoë esculenta. Mellita testudinata.
Station 6057	4¼ fms.; sticky mud; dredge.		Amphipholis goesii.	
Station 6058	7½ fms.; sticky mud; 7-foot trawl.	Astropecten duplicatus.	Amphipholis goesii.	
Station 6059	7 fms.; sticky mud; 7-foot trawl.	Echinaster crassispina.	Amphipholis goesii.	Brissopsis lyrifera.
Station 6060	12 fms.; sticky mud; dredge.		Amphipholis goesii.	
Station 6061	12 to 18 fms.; mud and sand; 11 ft. trawl.		Amphipholis goesii.	
Station 6062	25 to 30 fms.; sand, mud, and shells; dredge.		Amphipholis goesii. Ophioglypha ljungmani.	
Station 6063	75 to 76 fms.; rocks, sand, and coral; 11 ft. trawl.		Amphipholis goesii. subtilis. Astroporpa annulata. Ophiomusium eburneum elegans.	

Asteroidea, Ophiuroidea, and Echinoidea collected by the Fish Hawk at western end of Porto Rico—Cont'd.

Station.	Depth, bottom, and apparatus.	Asteroidea.	Ophiuroidea.	Echinoidea.
Station 6064	22 to 23 fms.; sand and mud; dredge.		Ophioglypha ljungmani Ophiothrix angulata.	
Station 6065	4 to 6 fms.; coral; dredge.		Amphiodia planispina.[a] Ophiothrix angulata. oerstedii.	
Station 6066	161 to 172 fms.; sand, mud; 11 ft. trawl.		Amphiodia riisei. Amphiura flexuosa.	
Station 6067	97 to 120 fms.; coral; dredge.		Amphioplus stearnsii. Astroschema oligactes. Ophioglypha robusta. Ophiomusium sculptum. Ophioplinthaca spinissima. Ophiopsila fulva. Ophiothrix angulata. suensonii. Ophiothyreus goesii. Ophiozona tessellata.	Doricidaris papillata.
Station 6070	220 to 225 fms.; rocks; 9 ft. trawl.		Ophiacantha bidentata. Ophiomusium eburneum elegans. Ophiomusium validum. Ophiopristis hirsuta.	Asthenosoma hystrix. Dorocidaris papillata. Palæopneustes hystrix.
Puerto Real		Astropecten antillensis. Echinaster crassispina. Luidia senegalensis.	Ophionereis reticulata. Ophiothrix angulata. œrstedii. Ophiura brevicauda. brevispina.	Mellita testudinata.
Station 6072	7¼ fms.; coral, sand, and shells; tangle.	Astropecten duplicatus. Echinaster crassispina.	Ophiothrix angulata.	
Station 6075	8¼ fms.; sand and coral; tangle.		Ophiothrix angulata. Ophiura brevicauda.	Cidaris tribuloides.
Boqueron Bay			Ophiothrix angulata. suensonii.	Echinometra subangularis. Toxopneustes variegatus.
Station 6076	10 fms.; coral and sand; tangle.		Ophiacantha ophiactoides. Ophiocoma pumila.	
Station 6077	10¼ fms.; coral and sand; tangle.		Ophiocoma pumila.	

On the southern side of the island the only echinoderms collected were in shallow water at the three following places:

Station.	Asteroidea.	Ophiuroidea.	Echinoidea.	Holothurioidea.
Guanica		Ophionereis reticulata. Ophiothrix angulata. Ophiura appressa.	Hipponoë esculenta.	Holothuria mexicana. surinamensis. Holothuria densipedes. impatiens. surinamensis.
Ponce[a]	Asterina folium. Linckia guildingii. Ophidiaster guildingii. Pentaceros reticulatus.	Ophiactis krebsii. Ophialcæa glabra. Ophiocoma echinata. pumila. Ophiothrix angulata. œrstedii. Ophiura appressa. cinerea. brevicauda. rubicunda. Ophiozona impressa.	Diadema setosum. Echinometra subangularis. Echinometra viridis. Hipponoë esculenta. Mellita testudinata. Toxopneustes variegatus.	
Arroyo	Astropecten antillensis.	Ophiothrix œrstedii. Ophiura brevispina.	Cidaris tribuloides. Diadema setosum. Echinometra subangularis. Hipponoë esculenta. Mellita sexforis. testudinata. Toxopneustes variegatus.	Holothuria grisea.

[a] Of the 24 species taken at Ponce, 7 were not taken at any other point, and 2 are new to science.

At the eastern end of the island the collecting was extended to within a few miles of St. Thomas, and included both Vieques and Culebra islands. This region proved rich in brittle-stars, 21 species being taken, of which 6 were not taken elsewhere, and 2 are apparently new to science.

Of the Crinoidea, *Actinometra rubiginosa* was taken with the tangle, from coral bottom, at station 6088, in 23 fathoms, and station 6090, in 16 fathoms.

Of the Holothurioidea, *Holothuria captiva*, *H. glaberrima*, and *H. grisea* were obtained at Hucares; *H. impatiens*, *H. mexicana*, and *H. rathbuni* at Ensenada Honda (Culebra), and *H. mexicana* at Fajardo.

Table showing the Asteroidea, Ophiuroidea, and Echinoidea obtained by the steamer Fish Hawk at the eastern end of the island of Porto Rico.

Station.	Depth, bottom, and apparatus.	Asteroidea.	Ophiuroidea.	Echinoidea.
Hucares	....	....	....	**Toxopneustes variegatus.**
Stations 6097, 6098, and 6099.	9¼ to 12¼ fms.; coral; tangle.	Luidia alternata	Ophiocoma pumila Ophiothrix angulata. Ophiura rubicunda.	**Toxopneustes variegatus.**
Station 6079	20 to 23 fms.; coral; tangle.	....	Ophionereis reticulata. Ophiopsila riisei. Ophiostigma isacanthum. Ophiothrix angulata. suensonii. Ophiura brevispina.	
Station 6080	20 to 23 fms.; coral; dredge.	....	Ophiactis krebsii. Ophiocoma pumila. Ophionereis reticulata. Ophiopsila fulva. riisei. Ophiothrix angulata. Ophiura brevispina.	
Caballo Blanco	....	....	Ophiocoma echinata. Ophionereis reticulata. Ophiothrix œrstedii. Ophiura appressa. brevicauda.	
Station 6084	11 fms.; coral, sand, and shells; tangle.	Astropecten duplicatus. Luidia clathrata.	....	
Station 6085	11 fms.; coral, sand, shells; 7 ft. trawl.	Astropecten duplicatus.	....	**Mellita sexforis.**
Station 6086	14¾ fms.; coral and sand; dredge.	....	Ophiolepis elegans. Ophiura brevispina.	
Ensenada Honda (Culebra).	....	Linckia guildingii	Ophiocoma echinata pumila. Ophiomyxa flaccida. Ophionereis reticulata. Ophiothrix angulata. œrstedii. Ophiura appressa. brevicauda. brevispina. cinerea. rubicunda.	**Echinometra subangularis.**
Station 6087	14¾ fms.; coral and sand; tangle.	....	Ophiothrix angulata	**Cidaris tribuloides.**
Station 6088	23 fms.; coral; tangle.	....	Ophionereis reticulata. Ophiura appressa.	
Station 6090	16 fms.; coral; tangle.	....	Ophionereis dubia.	
Station 6091	15 fms.; coral; tangle.	Astropecten duplicatus. Echinaster crassispina.	....	
Station 6093	15 fms.; coral; tangle.	....	Ophiura appressa.	
Station 6095	12¼ fms.; coral; tangle.	....	Ophiocoma pumila.	
Station 6096	6 fms.; coral; tangle.	Astropecten duplicatus.	Ophiactis longibrachia. Ophiocoma echinata. Ophionereis olivacea. Ophiothrix angulata. œrstedii. Ophiura brevispina.	
Fajardo	....	....	Ophiocoma echinata	**Echinometra subangularis.** **Echinanthus rosaceus.**

On the north shore the collecting was all done in the neighborhood of San Juan, and brought to light a number of species not taken elsewhere. The Asteroidea obtained were *Echinaster crassispina*, *Linckia guildingii*, *Luidia senegalensis* and *clathrata*, *Pentaceros reticulatus*, *Zoroaster fulgens*. The following table shows the distribution of Ophiuroidea, Echinoidea, and Holothurioidea in this region:

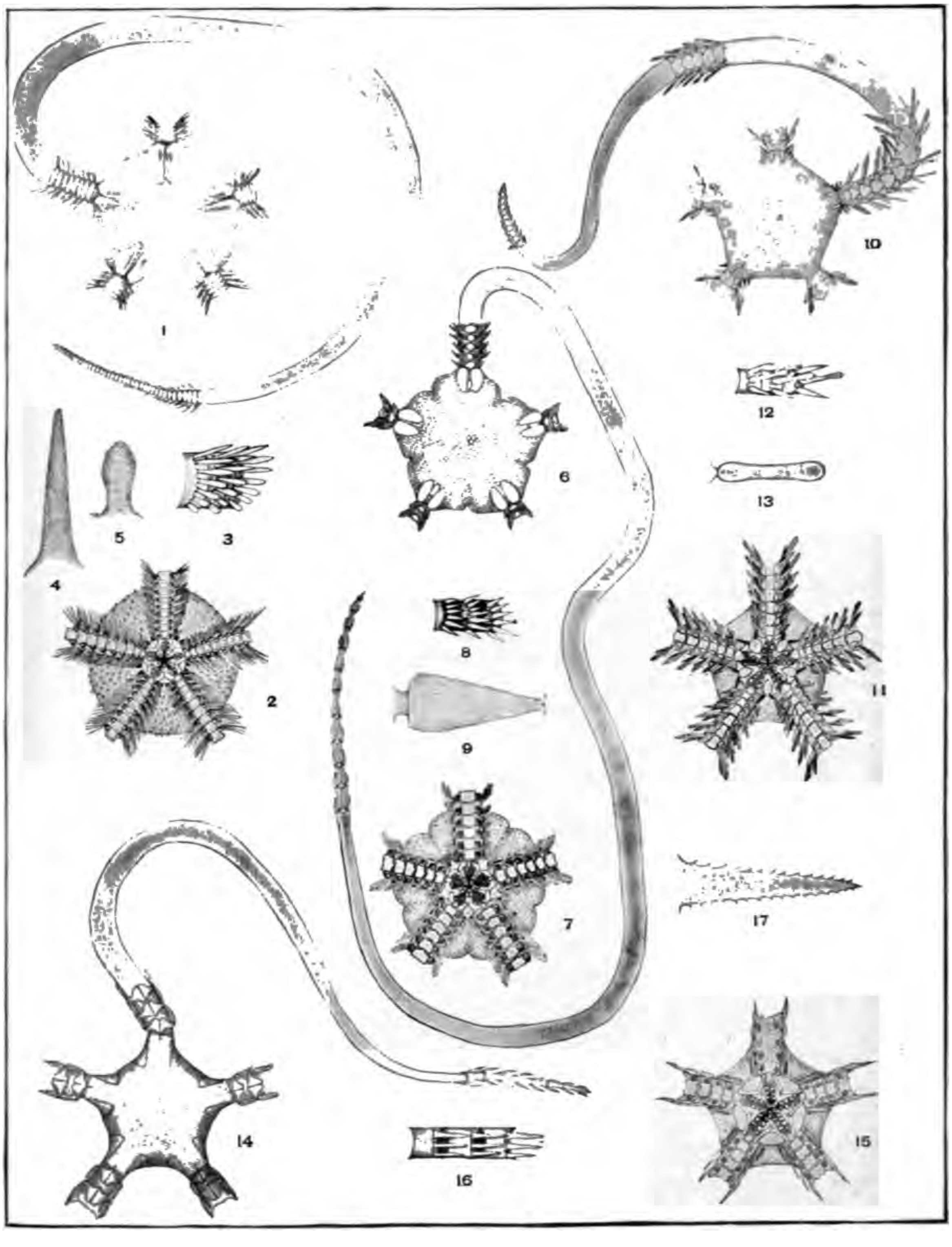
Station.	Depth, bottom and apparatus.	Ophiuroidea.	Echinoidea.	Holothuroidea.
San Juan		Amphiodia pulchella.	Echinometra subangularis.	Holothuria mexicana.
		Ophiothrix angulata.	Toxopneustes variegatus.	Holothuria surinamensis.
				Stichopus möbii.
Collected by Mr. Gray from vicinity of San Juan.		Ophiocoma echinata.	Cidaris tribuloides.	Holothuria glaberrima.
		Ophiocoma pumila.	Diadema setosum.	Holothuria grisea.
		Ophiocoma riisei.	Hipponoë esculenta.	Holothuria impatiens.
		Ophiomyxa flaccida.		Synapta lappa.
		Ophiura appressa.		
		Ophiura brevicauda.		
		Ophiura cinerea.		
Station 6050	91 fms.: sand and mud; 7 ft. trawl.	Amphiura bihamula.		
		Ophioglypha robusta.		
		Ophioscolex serratus.		
		Ophiozona nivea compta.		
Station 6051	45 fms.: sand and mud; tangle.	Ophioglypha ljungmani.		
Station 6053	4 to 7¾ fms.: fine sand; dredge.	Amphipholis limbata.	Mellita testudinata.	
Station 6054	1¾ to 5¼ fms.: sand and mud; dredge and tangle.	Amphipholis goesii.		

SUMMARY.

An examination of the collections made at the various stations as given above shows that Mayaguez and its vicinity proved to be the best locality for the collecting of echinoderms, although the vicinity of Culebra Island and that of San Juan Harbor, each offers a very good field. At Mayaguez, within a radius of 9 miles, 43 species were collected (2 crinoids, 5 asteroids, 25 ophiuroids, 8 echinoids, and 3 holothurians), of which 24 were not taken elsewhere and 1 is new to science. In the vicinity of Culebra about 40 species were taken (1 crinoid, 5 asteroids, 21 ophiuroids, 5 echinoids, and 8 holothurians), of which 11 were not taken elsewhere and 2 are new. At San Juan, within a radius of 1¼ miles, 35 species have been collected (6 asteroids, 16 ophiuroids, 6 echinoids, and 7 holothurians), of which 8 were not taken elsewhere and 2 are new. The littoral collecting at San Juan proved the best, perhaps because more thoroughly done, but Ponce is a close second, and nearly a third of the species taken at the latter place were not found elsewhere. San Juan proved to be the best place for starfishes, Ponce or Culebra for littoral brittle-stars, Arroyo or Ponce for littoral echinoids, and San Juan for holothurians. Of littoral forms, the commonest starfish is apparently *Pentaceros reticulatus*, the commonest brittle-star *Ophiocoma echinata* or *Ophiothrix angulata*, the commonest sea-urchin *Toxopneustes variegatus* or *Echinometra subangularis*, and *Stichopus möbii* is probably the commonest holothurian.

Olivet College, *September 15, 1900.*

PLATE 14.



Figs. 1–5. *Ophiactis longibrachia.*—Fig. 1, upper surface, × 1.5. Fig. 2, under surface, × 1.5. Fig. 3, side view of 3 joints of arm, showing the number and proportions of the arm-spines, × 5. Fig. 4, one of the upper spines, × 20. Fig. 5, one of the lower spines, × 20.

Figs. 6–9. *Amphiura bihamula.*—Fig. 6, upper surface, × 4. Fig. 7, under surface, × 4. Fig. 8, side view of 3 joints of arm, showing the number and proportions of the arm-spines, × 10. Fig. 9, one of the lower spines, showing the little hooks at the end, × 40.

Figs. 10–13. *Ophionereis olivacea.*—Fig. 10, upper surface, × 3. Fig. 11, under surface, × 3. Fig. 12, side view of 3 joints of arm, showing the number and proportions of the arm-spines, × 4. Fig. 13, one of the middle arm-spines, × 10.

Figs. 14–17. *Ophioscolex serratus.*—Fig. 14, upper surface, × 3. Fig. 15, under surface, × 3. Fig. 16, side view of 3 joints from near middle of arm, showing the number and proportions of the arm-spines, × 5. Fig. 17, one of the upper arm-spines, × 20.

numerous, though somewhat smaller, dorsally. The papillæ are numerous and confined to the dorsal surface. There is no sign of arrangement in rows of either the pedicels or papillæ. Tentacles very small and pale, apparently 20. Polian vessel 1. Stone canal 1. Water-ring with many small bead-like bodies on it. Cuvier's organs present; small, greenish. Genital glands with numerous infrequently branched filaments. The calcareous deposits consist of tables and smooth buttons, with numerous supporting rods in pedicels, papillæ, and tentacles. The buttons usually have three pairs of holes, but not infrequently there are only 3 or 4 holes. The tables have the disk with 4 large central holes or a single deeply 4-lobed hole, surrounded by a circle of smaller holes, 4 larger alternating with 4 smaller, to complete the circle. The spire is comparatively low, with only 1 crossbeam and few (not more than 10 or 12) teeth. The tables of the pedicels are usually much reduced.

The supporting rods of the tentacles are simple, slightly rough or knobbed at ends. Those from the pedicels are usually broader and pierced by holes more or less symmetrically arranged. There are often 7 or 8 pairs of these holes. The calcareous ring is composed of 5 large radial pieces and 5 small, narrow, pointed interradial plates. The calcareous ring and the various calcareous deposits are exactly like those of *H. rathbuni* Lampert, from which species this form is otherwise radically different. (See pl. 17.) It differs from its nearest allies in the crowded papillæ on the dorsal surface, as well as in the detailed structure of the tables, while it differs markedly from *H. glaberrima* in the large size of the pedicels and papillæ, and in their crowded arrangement. It is known as yet only from Porto Rico.

5. **Holothuria glaberrima** Selenka.

Especially common in cavities in coral rocks on the reefs and along shore. It is rather short and stout, seldom more than 100 mm. long. The color varies greatly from pale yellowish brown to almost black, but is generally uniform over the body. The body-wall contains only scattered branching rods. It is found throughout the Caribbean Sea and Gulf of Mexico. Six specimens from Hucares vary in length from 65 to 110 mm. In five the color is blackish brown, the tentacles black; the sixth is light yellowish brown, with light tentacles.

6. **Holothuria grisea** Selenka.

This species reaches a length of 150 to 200 mm. The body-wall contains tables and small forked rods, the latter gathered in little circles or spots, often visible to the naked eye. It has been recorded from the West Indies, Surinam, and Brazil. Two specimens from Arroyo, 50 and 110 mm. long, and one from Hucares 70 mm.

7. **Holothuria impatiens** Forskal.

This is one of the most widely distributed of holothurians, being known from the warmer seas of all parts of the world. It reaches a length of 150 to 200 mm., and is grayish purple in color, sometimes blotched with darker. Tentacles often very light colored. The body-wall contains tables and buttons with 3 pairs of holes. From Culebra there is one typical specimen 85 mm. long, and from Ponce there are two specimens (110 to 125 mm.) which are dark gray in color with no trace of purple.

8. **Holothuria mexicana** Ludwig.

This is one of the largest West Indian holothurians, often reaching a length of 450 mm. or more. The color varies greatly; some specimens, usually small ones, are light brown above and pink or flesh-color beneath, the pedicels brown; others are almost jet-black with scarcely any light below. Between these two extremes all sorts of intergradations occur. The thick, leathery body-wall, which contains simple tables and numerous perforated plates of two kinds, helps greatly to distinguish this species. Described first from the Gulf of Mexico, and known only from the West Indian region.

Of this very common species, there are some 20 specimens in the collection, from 110 to 300 mm. in length. There is great diversity in the number of tentacles and Polian vessels. Four individuals have 18 tentacles; six have 19; nine have 20; one has 21. Two individuals have 1 Polian vessel each; two have 2; five have 3; two have 4; three have 7; one has 8; one has 9. These specimens were collected at Culebra, Fajardo, Boqueron Bay, Guanica, Puerto Real, Mayaguez, and San Juan.

9. **Holothuria rathbuni** Lampert. (Pl. 17, figs. 2 to 10.)

This species reaches a length of 200 mm. The body-wall contains tables and buttons with three pairs of holes. Occurs from Bermuda to Brazil.

There is a small holothurian in the collection from Culebra, which I have finally decided to consider a young specimen of this species. *H. rathbuni* was first described by Mr. Richard Rathbun from specimens collected at Rio Janeiro, but he gave no name to it. In 1885 Lampert, without any further information, gave the species the name *rathbuni*. Among holothurians which I collected in Jamaica in 1896 and 1897, there are numerous specimens which may be referred without doubt to Mr. Rathbun's species. In 1899 the New York University party collected similar specimens on the south shore of the Bermuda Islands. These specimens all agree in coloration, size, and calcareous parts, as well as in habits, with the specimens from Brazil, as described by Mr. Rathbun. The Porto Rican specimen before me is only 50 mm. long, and is rather spindle-shaped, tapering towards both ends. The pedicels are confined to the ambulacra, where they form five double rows, which are very distinct near the two ends, but rather indistinct at the middle. Tentacles 20 in number, small and pale. Color light gray with a decidedly yellow tinge ventrally, more or less distinctly marked on the interambulacra with purplish black. Cuvier's organs are present, dirty green in color. There is no genital gland, which adds strength to the opinion that this is a young individual. It differs from adults in the arrangement of the pedicels, which are in them irregularly scattered. As no figures have ever been published of the calcareous parts of *H. rathbuni*, it seems wise to give them in connection with this individual.

10. **Holothuria surinamensis** Ludwig.

This very common species reaches a length of about 150 mm. The body-wall is often very thin. It contains a few irregular rods and numerous imperfect tables which lack the disk. Occurs from Bermuda southward to Surinam and into the Gulf of Mexico. About half of the holothurians collected by the *Fish Hawk* consist of this species, of which there are 40 specimens, 30 to 140 mm. in length, from Ponce, Boqueron Bay, San Juan, Puerto Real, and Guanica. In some the "bars" in the skin are numerous and very noticeable and the tables are heavy, while in others the "bars" are rather infrequent and the tables more delicate.

11. **Synapta lappa** Müller.

This large synapta reaches a length of 600 mm., or even more. The color varies considerably, from light gray to dark brown. The body-wall is thin and contains numerous "anchors and plates" (characteristic of the genus) and great quantities of miliary granules. It is found under rocks on sandy bottom in shallow water throughout the West Indies. Mr. Gray's collection contains a single specimen, found under a rock near San Juan.

Besides the species with the "shield-shaped" tentacles, there will doubtless be found along the shores of Porto Rico representatives of another family of holothurians, the *Dendrochirotæ*. Of this family *Cucumaria punctata* Ludwig and species of *Thyone* are almost sure to occur. Of the *Synaptidæ*, besides *Synapta lappa* Müller, *Synapta vivipara* (Œrstedt) and *Chiridota rotifera* Pourtales will very probably be collected. Moreover, another genus of the *Aspidochirotæ* (of which *Holothuria* is a typical genus), *Mülleria*, may occur. This latter genus can be easily recognized by the five prominent calcareous teeth in the anus. It is brown, mottled with darker and lighter shades, and reaches a length of 300 mm., or thereabouts. *M. agassizii* Selenka, with 25 to 30 tentacles, has been collected in Florida, Haiti, the Tortugas, Bimini, and Jamaica. *Cucumaria punctata*, which reaches a length of 70 or 80 mm., may be recognized by the 10 much-branched dendriform tentacles, the bluish-gray color, and the yellowish pedicels, which occur in double rows along the ambulacra but are also somewhat scattered on the rest of the body. It occurs in cavities within and underneath broken rocks, from Bermuda to Barbados. *Thyone*

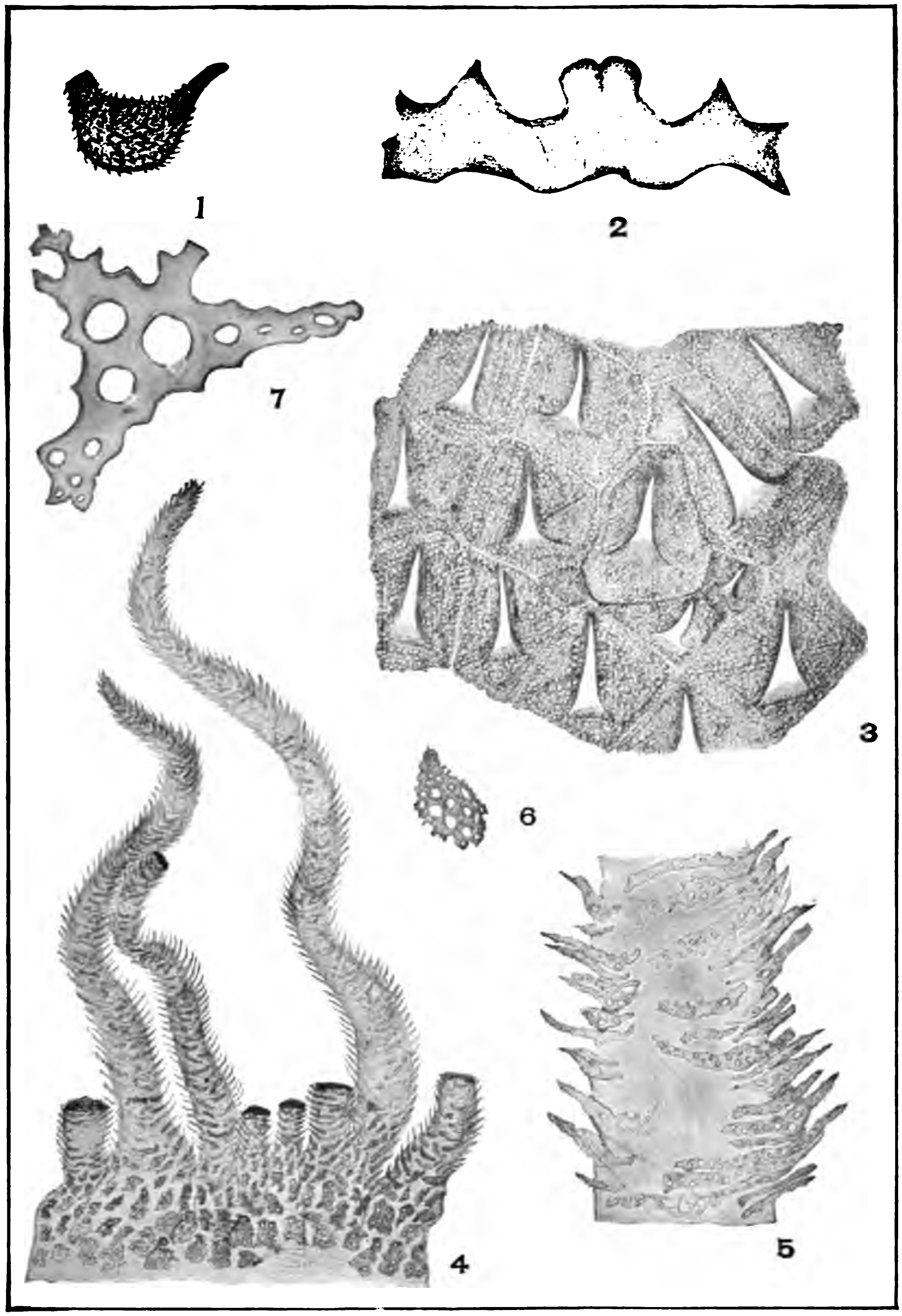


Fig. 1. *Echinocucumis asperrima* Théel, natural size.
2. Part of the calcareous ring. × 45.
3. Part of the body wall from the outside. × 20.
4. The circle of tentacles (some are broken and some may be wanting). × 20.

Fig. 5. Part of a tentacle, to show the way in which the calcareous rods project. × 90.
6. A plate from the body wall near the circle of tentacles. × 90.
7. A plate from the base of a tentacle. × 450.

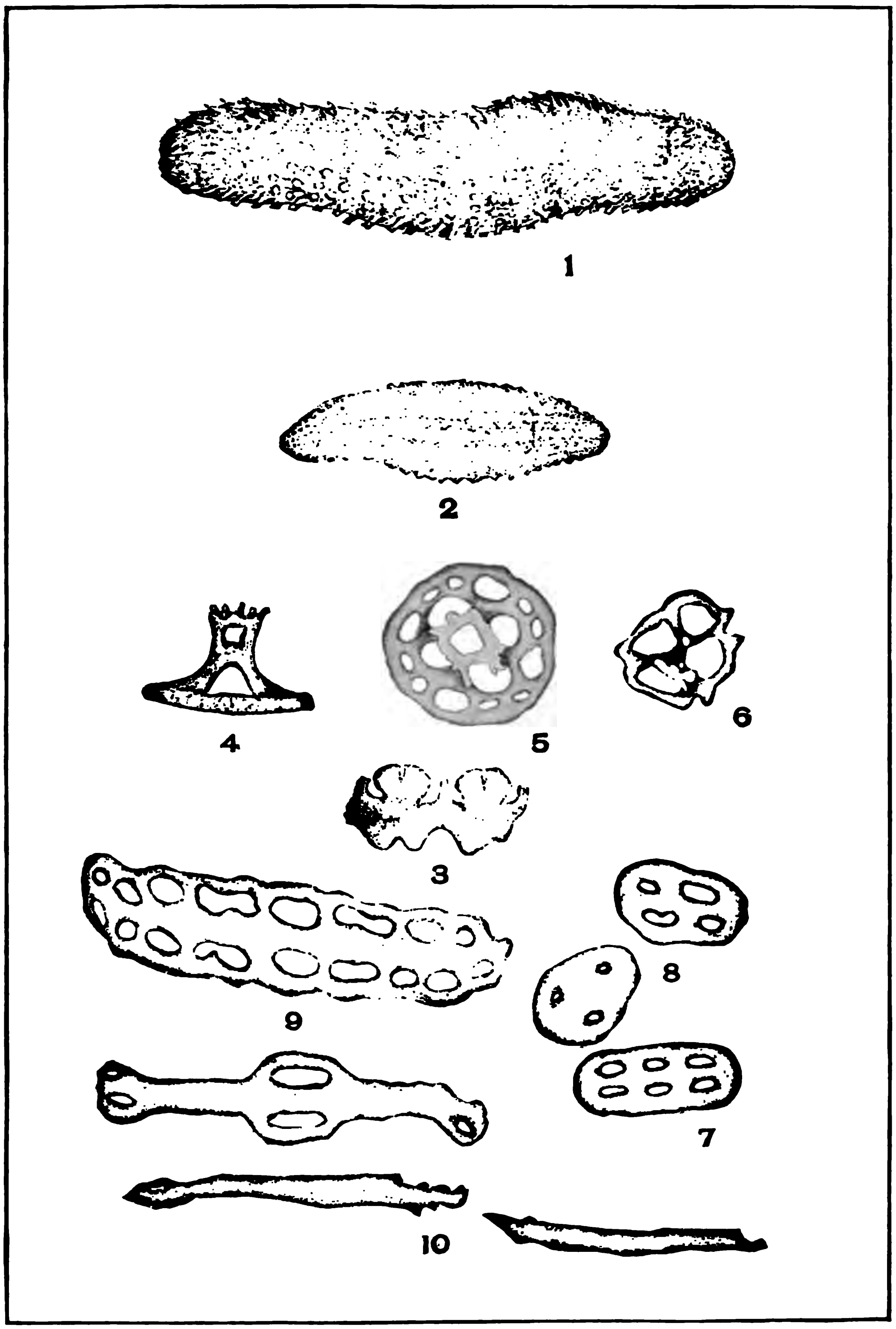


Fig. 1. *Holothuria densipedes*, n. sp., natural size.
2. ? *Holothuria rathbuni* Lamp., young, natural size.
3. Part of the calcareous ring of *H. rathbuni*. × 5.
4. Calcareous table from the skin of *H. rathbuni*, seen from the side. × 450.
5. Table seen from above. × 450.

Fig. 6. Incomplete table from pedicel. × 450.
7. Normal button of *H. rathbuni*. × 450.
8. Incomplete buttons. × 450.
9. Supporting rods from pedicels. × 450.
10. Supporting rods from tentacles. × 450.

Figs. 3–10 would answer equally well for *Holothuria densipedes*.

THE ALCYONARIA OF PORTO RICO.

BY

CHARLES W. HARGITT, Ph. D.,

AND

CHARLES G. ROGERS, A. M.

THE ALCYONARIA OF PORTO RICO.

By CHARLES W. HARGITT AND CHARLES G. ROGERS.

INTRODUCTORY.

The collection, of which the following paper gives a synopsis, was made during the winter of 1898–99, in and about the island of Porto Rico. It comprised some 25 separate packages, but of these several were duplicates from different stations and several so very fragmentary as to render an adequate description difficult, not to say impossible. Hence, while to most of them brief reference will be made in the appropriate portion of the report, to others no notice beyond the present will appear.[1]

The material was in part preserved dry and in part in alcohol, but apparently by methods which failed to secure proper expansion of the polyps to facilitate their morphological study. In only two cases were polyps found in anything like an expanded or normal condition, and the dried specimens were in some cases badly distorted and crushed, leaving them difficult to determine. These facts, together with the very fragmentary condition of many specimens, have rendered the matter of determination unusually difficult.

While comparatively small, both as to the number of genera and species, the collection is not without some new interest, as at least two of the genera are entirely new to the region and several of the species are probably new to science. It will also be noted that one of the genera new to these waters comes from a depth greater than that common to most of its species—namely, that of *Spongodes*, taken from a depth of 75 fathoms. Further notice of this will be made in connection with its description.

While the senior author is responsible so far as the final determination and descriptions in the report are concerned, Mr. Rogers assumes responsibility for the synoptic table and for certain of the sketches, especially of spicules. No attempt has been made to give details of synonymy in connection with the descriptions of species.

Acknowledgments are made of the courtesy of the director of the biological laboratory of the U. S. Fish Commission, Woods Hole; also to the Museum of Comparative Zoology, Harvard University, to the director and curators of the U. S. National Museum, and to the Academy of Natural Sciences, Philadelphia, for favors shown; and to the Peabody Museum, of Yale University, for the privilege of examining specimens of the collection.

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[1] As compared with the earlier collections made by the *Blake*, 1880, the *Fish Hawk*, 1880–82, and the *Albatross*, 1883, the present is notably lacking in some of the more remarkable groups of the Alcyonaria, especially the *Pennatulacea* and *Alcyonacea*. As will be noted, the present collection is practically limited to the *Gorgonacea*. While naturally a somewhat larger proportion in both genera and species would be expected among the Gorgonias, still their extreme preponderance in the present collection is somewhat surprising. Whether the difference may in any wise be due to seasonal influence it is impossible to say. It may also be noticed that the collection was comparatively small in the number of specimens taken, except in a very few cases.

THE ALCYONARIA.

The order Alcyonaria includes those members of the class Anthozoa, Phylum Cœlenterata, characterized by the presence of eight pinnate tentacles and a corresponding number of mesenterial filaments or folds, with or without definite skeletal structures. All are of marine habit, and most are colonial, forming more or less complex clusters or groups of polyps united to a common stock. The buds which go to make up the colony arise usually from stoloniferous extensions of the body wall at the base of the polyp, or from disk-like expansions, containing nutritive canals which ramify through the more or less fleshy cœnenchyma and which give rise to secondary stems, branches and sub-branches, often forming a very complex, dendritic structure more resembling a plant than an animal, as, for example, in the beautiful "sea-fans," "sea-plumes," etc. Hence the term "Zoophyte," by which the older naturalists designated them.

Calcareous particles or spicules of an almost infinite variety of form are usually present in some part of the tissues, chiefly in the so-called cœnenchyma of the stem and branches, as well as in the tentacles and body of the polyps. They may occur somewhat promiscuously scattered throughout the tissues, or may be limited more or less to certain portions of the colony, or may become coalescent to form definite skeletal structures, as the axis of red coral or of the sea-fans. In certain forms, as the *Cornularidæ*, instead of calcareous spicules there may be a chitinous or horny secretion over the polyp walls and stolons.

So remarkable a feature do these spicular bodies form that elaborate systems of classification have been based upon their peculiarities, including families, genera, and even species. Indeed, at present, it may be said that these form one of the chief taxonomic characters in general use. Some doubt has, however, been recently thrown upon this method, notably by Hickson,[1] who has shown that they are of a very variable nature, even under ordinary conditions of depth, temperature, etc. These variable conditions may greatly modify their size, form, and color—the very features which have been held to be of diagnostic importance.

To some extent my own observations confirm those of Hickson, and I more than suspect that not a little revising of present categories of classification will be an early necessity. While among some groups there may be found a certain stereotyped form and size of spicular body, it does not seem to me that it can hold anything like the place of importance which has hitherto been claimed for it.

The following synoptic table or key has been compiled from several sources, chiefly from Edwards and Haime, Histoire Naturelle des Coralliarres; Kolliker, Icones Histologicæ; Kukenthal, Alcyonaceen von Ternate; the Synopses of Bronn, Klaseen und Ordnungen d. Thierreichs; Leunis, Synopsis der Thierkunde; Kent, on the Spicules of Gorgonaceæ; Wright and Studer, Report on the Alcyonaria of the Challenger Expedition, vol. XXXI. These have been supplemented by free reference to special papers and descriptions and by such notes as have seemed helpful and available for the more ready determination of family, if not generic, relations, by the ordinary collector or student. While under each family the recognized genera are named, only those coming within the range of West Indian or West Atlantic coast waters are included in the generic synopses.

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[1] Report Third International Congr. of Zoologists, p. 352.

The following authors have also been consulted in the preparation of the report:

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ALCYONARIA.

Polyps and polyp colonies having eight pinnate tentacles and eight mesenteric folds.

Order 1. ALCYONACEA Verrill.

Polyps single or in colonies; when the latter they are united by endodermic nutritive canals; are without axial skeleton.

I. Haimeidæ. Polyps single, with or without spicules.

II. Cornularidæ. Polyps not united in bundles at the base to a stem or foot, but have cuticle-like or stolon-like expansions or are branched and bear lateral buds.

III. Tubiporidæ. Colonies formed of parallel tubular polyps and united by horizontal platforms containing endodermal canals. Colonies form calcified stocks of numerous calcareous tubes arising from the coalescence of spicules of the mesoderm. Anterior portion of polyps is retractile.

IV. Xenidæ. Colony consists of masses of long cylindrical polyps bearing terminal crowns of nonretractile tentacles. Polyps united in their lower portion by a canal system ramifying in a connecting cœnenchyma, which contains a few calcareous spicules.

V. Organidæ. Elongated polyps united together so as to form a short upright stem. Polyps retractile. Spicules present in both polyp and tentacles.

VI. Alcyonidæ. Polyp stalk fleshy, sometimes simple, sometimes irregularly branched. Basal portion generally without polyps. Polyp tubes, contained in the thick cœnenchyma, are united by endodermal canals, from which buds are formed. Isolated spicules are found in the cœnenchyma.

VII. Nephthyidæ. Upright branched polyp colonies, consisting of a sterile trunk and branches ramifying in a most varied manner and bearing terminal polyps. Polyps do not exhibit separate calycine and tentacular regions, and the latter does not invaginate. Tentacles fold over oral disk when at rest. Buds arise from small endodermal canals between the polyps.

VIII. Helioporidæ. Compact corallum formed of a fibro-crystalline calcareous mass. This is formed from a cœnenchyma made up of numerous tubes and from calyces with an irregular number of septa-like parietal ridges. Calyces and tubes of cœnenchyma are closed below by a series of transverse floors. Polyps completely retractile, and tentacles are invaginated. Delicate canals furnish communication between individual tubes and calyces.

Family I. HAIMEIDÆ.

(1) *Hæmea* Milne-Edwards. (2) *Hartea* Wright. (3) *Monoxenia* Haeckel.

None of these genera is found within the territory covered by this paper.

Family II. CORNULARIIDÆ.

1. *Cornularia* Lamarck.
2. *Rhizoxenia* Ehrenberg.
3. *Clavularia* Quoy & Gaimard.
4. *Sarcodictyon* Forbes.
5. *Anthelia* Savigny.
6. *Gymnosarca* S. Kent.
7. *Cornulariella* Verrill.
8. *Telesto* Lamouroux.
9. *Cœlogorgia* Milne-Edwards.
10. *Cyathopodium* Verrill.
11. *Scleranthelia* Studer.
12. *Anthopodium* Verrill.
13. *Sympodium* Ehrenberg.
14. *Erythropodium* Kolliker.
15. *Callipodium* Verrill.
16. *Pseudogorgia* Kolliker.

Probably not more than five genera of this family have been found in the North Atlantic near the American coast.

7. CORNULARIELLA. Colony consists of a series of creeping stolons from which the tubular polyps arise. Polyps have large tentacles, with short, thick pinnæ; the upper portion of each polyp has few spicules and is retractile within the lower portion, which is quite rigid from being packed with numerous warty spindles.

8. TELESTO. The polyps arise from a membranous base or from stolons, and have deep gastral cavities. Lateral buds spring forth from their body walls. The walls of the polyp calyces contain spicules, which may sometimes be united by a horny substance.

12. ANTHOPODIUM. Colony is incrusting, firm. Polyps large, prominent, retractile within tubular verrucæ; surface of cœnenchyma and verrucæ minutely granular with the dentations of projecting spicules, which are irregular in outline and closely united together. Spiny spicules and clubs are also found.

13. SYMPODIUM. The base of the colony is a thin leathery membrane, from which the rather numerous polyps arise. Polyps are short, retractile, and deeply sunk into the basal membrane. Spicules very small and disk-like.

14. ERYTHROPODIUM. Colony has an incrusting membranous base. Polyps retractile within very small verrucæ. Spicules long, hexradiate, with rounded ends and small dentations.

Family III. TUBIPORIDÆ.

Tubipora Linnæus.

Family IV. XENIIDÆ.

Xenia Savigny.

Family V. ORGANIDÆ.

Organidus Danielssen.

Family VI. ALCYONIDÆ.

1. *Crystallophanes* Danielssen.
2. *Bellonella* Gray.
3. *Nidalia* Gray.
4. *Paralcyonium* Milne-Edwards.
5. *Sarakka* Danielssen.
6. *Alcyonium* Linnæus.
7. *Lobularia* Savigny.
8. *Sarcophytum* Lesson.
9. *Lobophytum* Marenzeller.
10. *Anthomastus* Verrill.
11. *Nannodendron* Danielssen.

6. ALCYONIUM. Colony presents appearance of variously lobed, soft masses, over the surfaces of which the polyps are spread. Polyps are completely retractile. Spicules chiefly spindles.

7. LOBULARIA. Colony like the preceding, but the short broad stem is furnished with a series of lobes or lappits, the cœnenchyma of which is thickly packed with spicules, clubs, and double clubs.

10. ANTHOMASTUS. Colony forms a rounded mass with a short barren peduncle, either directly adherent or fixed in mud by root-like peduncles. Polyps dimorphic. Autozooids large, few in number. Spicules, spiny and branching spindles.

Family VII. NEPHTHYIDÆ.

(*a*) Spongodinæ, in which the walls between the stem canals have few or no spicules.

1. *Verringia* Danielssen.
2. *Fulla* Danielssen.
3. *Barathrobius* Danielssen.
4. *Gersemia* Marenzeller.
5. *Gersemiopsis* Danielssen.
6. *Drifa* Danielssen.
7. *Duva* Koren & Danielssen.
8. *Eunephthya* Verrill.
9. *Ammothea* Savigny.
10. *Nephthya* Savigny.
11. *Spongodes* Lesson, emend. Verrill.

(*b*) Siphonogorginæ, in which spicules are abundant in the walls of stem canals.

12. *Paranephthya* Wright & Studer.
13. *Scleronephthya* Wright & Studer.
14. *Chironephthya* Wright & Studer.
15. *Siphonogorgia* Kolliker.

4. Gersemia. Colony consists of an upright stem with a few simple branches bearing tufts of polyps with nonretractile tentacular regions. Only the body wall of the polyps, the tentacles, and the cortical layer of the stem are provided with spicules.

8. Eunephthya. Colony forms an upright stem, from which accessory branches are given off on all sides. These may again branch or give origin directly to tufts of polyps. Polyps are large, nonretractile, and covered with thorny club-shaped or branched spicules, the ends of which project beyond the surface. These occur only in the cortex of the stem, not on the walls of the canals.

11. Spongodes. Form of colony varies greatly according to the extent of the sterile trunk. Polyps are nonretractile. Their heads, containing large spicules, are arched over by tufts of large spindle-shaped spicules projecting as spines beyond the polyps. Internal septa not furnished with spicules. Cortex of stem and branches contain large spicules.

Family VIII. HELIOPORIDÆ.

Heliopora Blainville.

Order II. PENNATULACEA.[1]

Unattached polyp colonies having a stalk embedded in the mud or sand and a rachis bearing polyps. The stalk generally has an axial rod.

Section I. PENNATULEA.

Sea-feathers, with pinnules, rachis with a bilateral arrangement of polyps, elongated, cylindrical.

I. Pteroeididæ. Pinnules well developed, with siphonozoids on the pinnules.
II. Pennatulidæ. Pinnules well developed; siphonozoids on ventral and lateral sides of rachis.
III. Virgularidæ. Pinnules small, without a calcareous plate.
IV. Stylatulidæ. Pinnules small, with calcareous plate.

Section II. SPICATA.

Rachis elongated, cylindrical, with a bilateral arrangement of polyps; without pinnules. Polyps sessile.

V. Funiculinidæ. Polyps on both sides of rachis in distinct rows with cells. Ventral siphonozoids absent.
VI. Stachyptilidæ. Polyps (with cells) on both sides of the rachis in distinct rows.
VII. Anthoptilidæ. Polyps on both sides of the rachis in distinct rows, without cells.
VIII. Kophobelemnonidæ. Polyps on both sides of rachis in a single series, or in indistinct rows, large and without cells; rachis elongated, cylindrical; ventral streak of rachis without polyps.
IX. Umbellulidæ. Polyps on both sides of the rachis in a single series, or in indistinct rows, large and without cells; rachis short.
X. Protocaulidæ. Polyps on both sides of the rachis in a single series, or in indistinct rows, small and without cells.
XI. Protoptilidæ. Polyps on both sides of rachis in a single series, or in indistinct rows, with cells.

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[1] After Sedgwick from Kolliker.

SECTION III. RENILLEA.

Rachis expanded in the form of a leaf, with bilateral arrangement of the polyps on one side of the expansion, without pinnules. A single large siphonozoid terminates the end of the central stem.

XII. RENILLIDÆ.

SECTION IV. VERETILLEA.

Club-shaped colonies, without pinnules. Polyps arranged all around the rachis.

XIII. CAVERNULARIDÆ. Spicules long.
XIV. LITUARIDÆ. Spicules short.

Order III. GORGONACEA.

Fixed colonial Alcyonaria with a more or less firm internal axis, which is covered with a cœnenchyma from which the polyps with short body cavities arise.

SECTION I. SCLERAXONIA.

Upright, branched polyp colonies. Polyp tubes short, surrounded by a canaliferous cœnenchyma containing spicules. Stem of a cortical substance containing the polyps and a central medullary substance. The spicules of latter are generally packed, sometimes fastened together by a horny secretion, or even cemented into a strong axis by a calcareous material.

I. BRIAREIDÆ. Cœnenchyma a polyp bearing cortex and a medullary substance of closely packed spicules. SUBFAMILIES: (1) *Briareinæ*. Central mass with nutritive canals; genera 1 to 7. (2) *Spongioderminæ*. Central mass without nutritive canals; genera 8 to 10.

II. SCLEROGORGIDÆ. Distinct axis formed by a mass of closely intercalated spicules with dense horny sheaths. Axis surrounded by numerous canals. Polyps exhibit a wart-like protruding calyx, within which the tentacles may be completely retracted.

III. MELITODIDÆ. Axis well marked, jointed, the alternate segments being of a hard calcareous and of a soft horny substance, the soft joints being formed of loose calcareous spicules in a mesh of horny substance.

IV. CORALLIDÆ. Axis of a dense calcareous mass of spicules fused together.

SECTION II. HOLAXONIA.

Axis of horny or calcified horny substance, or of alternating joints of amorphous calcareous material and horn.

V. DASYGORGIDÆ Colony simple or branched; cœnenchyma thin; axis horny-calcareous; polyps large and distinct, not retractile. Both cœnenchyma and polyps contain smooth needles or spindles or scales. SUBFAMILIES: (1) *Strophogorginæ*. Axis simple, spicules rod-like or lenticular; genus 1. (2) *Chrysogorginæ*. Branched; polyps large, spicules flattened, irregular in form, scale-like; genera 2 to 5.

VI. ISIDÆ. Axis of alternating horny and calcareous portions. The horny joints, nodes, composed of connective tissue, irregularly calcified in delicate threads; calcareous matter amorphous. SUBFAMILIES: *Ceratoisidinæ*. Simple or branched; calcareous internodes very long; cœnenchyma thin; polyps long, imperfectly retractile; genera 1 to 6. (2) *Mopseinæ*. Branched from calcerous internodes; genera 7 to 9. (3) *Isidinæ*. Branched; cœnenchyma thick; polyps wholly retractile. Genus 11.

VII. PRIMNOIDÆ. Axis calcareous and horny; basal attachment always calcareous; polyp cups projecting, club-shaped; tentacular portion retractile. SUBFAMILIES: (1) *Callozostrinæ*. Genus 1. Cf. generic description. (2) *Calyptrophorinæ*. Genus 2. Cf. description. (3) *Primnoinæ*. Simple or branched; calyces bilateral; cœnenchyma usually contains small elongated scales; genera 3 to 11. (4) *Primnoidinæ*. Genus 12. Cf. description.

VIII. MURICIDÆ. Axis usually horny, surrounded by an outer layer of variously shaped spicules, spiny disks, and half spiny spindles, spiny needles, spiny stars, and scales; spines usually project beyond the surface of the cœnenchyma.

IX. **Plexauridæ.** Colony usually branched and upright; the axis horny or horny and calcareous, especially at the base; cœnenchyma thick; polyps scattered over entire surface; cups project little or not at all, appearing in many cases as pores in the cœnenchyma; spicules large and of various form; cortical mostly club-like, spindles beneath.

X. **Gergonidæ.** Colony upright and branched, usually in one plane; axis horny, rarely calcareous; polyps arise on stem and twigs in bilateral manner.

XI. **Gorgonellidæ.** Cœnenchyma thin and smooth on surface; spicules warty double stars and clubs; polyps on wart-like verrucæ, usually arranged biradially; axis lamellar and calcareous; branches and twigs frequently flattened.

Family I. BRIAREIDÆ.

Eleven genera belonging to this family have been described by various authors, of which four are found in this section:

1. *Leucoella* Gray.
2. *Solenocaulon* Gray.
3. *Semperina* Kolliker.
4. *Suberia* Studer.
5. *Anthothela* Verrill.
6. *Paragorgia* Milne-Edwards.
7. *Briareum* Blainville.
8. *Titanideum* Agassiz.
9. *Spongioderma* Kolliker.
10. *Icilogorgia* Ridley.
11. *Solanderia* Kolliker.

5. **Anthothela.** Coral either incrusting or irregularly branched. Branched forms with a distinct spiculose axis, composed of fusiform spicula. Callicles prominent; can not be retracted within cœnenchyma; eight-lobed at summit.

7. **Briareum.** Axis not well defined, penetrated by nourishing canals. Colony forms irregularly lobed upright masses. Polyps without calyces, completely retractile within cœnenchyma, disposed regularly on stem.

8. **Titanidium.** Stem less porous than in *Briareum*, spongy, and contains many characteristic spicules. Polyps scattered and not very prominent.

10. **Icilogorgia.** Stem brittle, formed of spicules packed closely together. The medullary portion is surrounded by a series of longitudinal canals. Colony upright, branched, with both stem and branches compressed. Polyps arise within a groove along the sharp edge of the branches, and are completely retractile.

11. **Solanderia.** Colony arborescent. Axis composed of a mass of closely packed unfused spicules containing no nourishing canals, but bounded by a layer of rather indefinite, nourishing canals.

Family II. SCLEROGORGIDÆ.

1. *Suberogorgia* Gray.
2. *Keroeides* Wright & Studer.

1. **Suberogorgia.** Colony upright, branched, with branches sometimes anastomosing. Axis formed of numerous closely intercalated spicules with dense horny sheaths. Polyps with slightly protruding calyces, disposed on either side of the flattened stems and branches. Cœnenchyma thick, with longitudinal furrows on the surface of areas free from polyps. Spicules are warty spindles, and in one species birotate.

2. **Keroides.** Colony upright, branched in one plane. Axis similar in structure to that of *Suberogorgia*, and retains its form after decalcification. The polyps form wart-like verrucæ, disposed mainly on the two sides of flattened branches, leaving a free interspace. Spicules are broad spindles and polygonal, often triangular disks.

Family III. MELITODIDÆ.

1. *Melitodes* Verrill.
2. *Mopsella* Gray-Ridley.
3. *Acabaria* Gray.
4. *Psilacabaria* Ridley.
5. *Wrightella* Gray.
6. *Clathraria* Gray.
7. *Parisis* Verrill

No genera of this family seem to have been found in West Indian waters.

Of the separateness of genera [illegible]

Family IV. CORALLIDÆ.

1. *Corallium* Lamarck.
2. *Pleurocorallium* Gray.

The genera of this family are closely related to those of the preceding family and have not been found in West Indian waters.

Family V. DASYGORGIDÆ.

1. *Strophogorgia* Wright.
2. *Iridogorgia* Verrill.
3. *Dasygorgia* Verrill.
4. *Chrysogorgia* Duch. & Mich.
5. *Herophila* Steenstrup.
6. *Lepidogorgia* Verrill.

1. STROPHOGORGIA. Colony simple, unbranched, erect or creeping. Axis horny and calcareous, iridescent. Base calcareous. Polyps prominent, stalked or sessile, disposed in a uniserial manner on stem. Cœnechyma sometimes very thin with few spicules, sometimes membraneous with numerous spicules.
2. IRIDOGORGIA. Colony consists of a main stem arising from a calcareous base. Axis horny, iridescent. Branches arise in an ascending spiral. Polyps large, perpendicular to stem or directed obliquely toward apex of stem, placed at wide intervals. Cœnenchyma thin, containing transparent spindles or scales, which are smooth or finely warty.
3. DASYGORGIA. Colony a main axis with spirally disposed branches. Axis and base as in preceding genus. Polyps large, generally perpendicular to stems, not retractile, placed at wide intervals; seldom more than two on one node. Last polyp never terminal. Spicules in two layers. Scale-like, smooth or slightly dentate at the margins.
4. CHRYSOGORGIA. Colony and axis very similar to preceding genus. Polyps narrowed at base and covered by long, spiny spicules, those at base of polyps being placed somewhat transversely.
5. HEROPHILA. Colony branched. Axis and base as above. Polyps, club-shaped, arise near ends of short twigs, beyond which projects a short, blunt stolon. Spicules are small warty spindles.
6. LEPIDOGORGIA. Colony a simple, tall, unbranched stem. Axis iridescent. Root divided into many divergent branches. Polyps large, prominent, directed obliquely upward, secund and far apart on the stem, which is covered by a thin layer of small oblong scales.

Family VI. ISIDÆ.

Of the eleven genera of this family, six are found in the north Atlantic, though not all have been reported from the West Indies.

1. *Bathygorgia* Wright.
2. *Ceratoisis* Wright.
3. *Lepidisis* Verrill.
4. *Callisis* Verrill.
5. *Acanella* Gray.
6. *Isidella* Gray.
7. *Sclerisis* Studer.
8. *Primnoisis* Wright & Studer.
9. *Mopsea* Lamarck.
10. *Acanthoisis* Wright & Studer.
11. *Isis* Linnæus.

2. CERATOISIS. Colony branched simply or not at all from calcareous internodes. Nodes horny, internodes calcareous and hollow in young specimens, becoming solid in older specimens. Base calcareous. Polyps large and prominent, with defensive calyx formed of eight large fusiform spicules starting below tentacles, scattered or arranged in a uniserial manner. Cœnenchyma thin and membranous, sometimes without spicules. Spicules fusiform or lenticular, or both.
3. LEPIDISIS. Colony simple or branched. Branches when present arise from horny nodes. Axis consists of long, solid or tubular calcareous internodes and short, horny nodes. Base with root-like projections. Polyps large. Cœnenchyma includes an outer layer of small, elongated scale-like spicules, with sometimes a few fusiform spicules beneath them.
4. CALLISIS. Colony branched from the calcareous internodes, which may be solid or very slightly hollow. Polyps short and contain spindle-shaped spicules. Cœnenchyma contains many flat scales. This genus, according to Wright & Studer, may be equivalent to *Ceratoisis*.
5. ACANELLA. Colony simple or branched. Branches when present arise in twos or threes from horny nodes. Axis as in *Lepidisis*. Polyps prominent, with numerous fusiform spicules, sometimes bent or twisted. Cœnenchyma thin. Tentacles imperfectly retractile.

7. **Sclerisis.** Colony upright, branched from internodes. Axis made up of short, disk-shaped, horny nodes and long, finely furrowed calcareous internodes. Calyces bell-shaped. Cœnenchyma very thin, without spicules. Spicules of calyces are larger, curved, and spinose.

11. **Isis.** Colony branched. Polyps wholly retractile within cœnenchyma. Cœnenchyma thick. Spicules radiately stellate with 6, 8, or 12 rough warts.

Family VII. PRIMNOIDÆ.

Although this family has a wide distribution, only four genera seem to have been reported from the north Atlantic along the American coasts.

1. *Callozostron* Wright.
2. *Calyptrophora* Gray, emend. W. & S.
3. *Primnoa* Lamouroux.
4. *Stachyodes* Wright & Studer.
5. *Calypterinus* Wright & Studer.
6. *Stenella* Gray.
7. *Thouarella* Gray, emend. W. & S.
8. *Amphilaphis* Wright & Studer.
9. *Plumarella* Gray, emend.
10. *Primnoella* Gray, emend. Studer.
11. *Caligorgia* Gray, emend. Studer.
12. *Primnoides* Wright & Studer.

3. **Primnoa.** Colony a single stalk or branched dichotomously or forming a bipinnate plume. Axis horny, calcified. Polyps on calciferous papillæ, club-shaped or scale-like, scattered irregularly. Spicules small, scoop-shaped in superficial layer.

6. **Stenella.** Colony feebly or irregularly and much branched. Axis hard, horny in young specimens, often highly iridescent. Polyps large and prominent, in whorls of 2–4, opposite. Cœnenchyma thin. Spicules large, disk-shaped, often concave with turned-up edges.

9. **Plumarella.** Colony upright, branched in one plane, fan-shaped. Axis brittle, calcareous. Polyps generally small, cylindrical; in alternating series, usually much separated. Cœnenchyma thin, with two layers of calcareous scales. Spicules thin, cycloid scales with central nucleus, prominences small, edge finely toothed.

11. **Caligorgia.** Colony ramified, mostly in one plane. Polyp calyces cylindrical or club-shaped, irregularly distributed on stem. Cœnenchyma thin, white, containing two layers of spicules. Calyx scales fan-shaped, warty, with ribs, arranged fan-like, which project as spines from upper edge.

Family VIII. MURICEIDÆ.

1. *Acanthogorgia* Gray & Verrill.
2. *Hypnogorgia* Duch. & Mich.
3. *Paramuricea* Kolliker & Verrill.
4. *Muriceides* Wright & Studer.
5. *Anthomuricea* Wright & Studer.
6. *Clematissa* Wright & Studer.
7. *Villogorgia* Duch. & Mich., Ridley.
8. *Anthogorgia* Verrill.
9. *Menella* Gray.
10. *Placogorgia* Wright & Studer.
11. *Echinomuricea* Verrill.
12. *Echinogorgia* Kolliker.
13. *Menacella* Gray & Ridley.
14. *Heterogorgia* Verrill.
15. *Astrogorgia* Verrill.
16. *Bebryce* de Phillipi.
17. *Acamptogorgia* Wright & Studer.
18. *Thesea* Duch. & Mich.
19. *Acis* Duch. & Mich.
20. *Elasmogorgia* Wright & Studer.
21. *Muricella* Verrill.
22. *Eumuricea* Verrill.
23. *Muricea* auct. emend. Verrill.

1. **Acanthogorgia.** Colony branching. Axis horny and fibrous. Polyp calyces elongated, expanded toward mouth, disposed irregularly. Anterior portion of polyp slightly retractile. Cœnenchyma thin. Spicules spindle-shaped and form large, beautiful extensions on polyp cups.

2. **Hypnogorgia.** Colony upright and branched. Branches pendulous. Axis horny and fibrous. Polyp calyces attached by inner surface to the axis of growth; operculum elevated and conical. Polyps on two sides of axis opposite or alternate. Spicules are long spindles.

3. **Paramuricea.** Colony generally large, upright, for the most part strongly branched in one plane. Axis horny, soft, flexible, translucent, generally flattened on thinner branches. Polyps short, cylindrical or verruciform, surrounded by short projecting spicules. Polyps disposed irregularly, generally three or four at ends of thickened branches, facing in different directions, none being exactly terminal. Cœnenchyma not very thick. Spicules are spiny needles, sometimes dentate, straight, curved, or bent at an angle.

6. CLEMATISSA. Colony branched in one plane. Terminal branches long, their apices being thickened and knob-like. Axis horny, soft, and flexible. Calyces bluntly conical and rise upright from stem and branches. Polyps disposed in short spirals on stem and branches. Termination of branch always formed by a polyp. Cœnenchyma thick, rough, and opaque. Spicules of cœnenchyma stout, usually thickened, with knob-like termination. Spicules of polyp spiny, club-like, thickened at one end.

7. VILLOGORGIA. Colony branched in one plane. Branches sometimes anastomose. Axis horny. Polyps cylindrical, perpendicular to stem. Cœnenchyma thin. Spicules of cœnenchyma 4–8 rayed stars with a few spindles. Spicules of polyps tripartite.

10. PLACOGORGIA. Colony upright, branched in one plane. Axis horny and flexible. Polyps short, cylindrical, and flattened on oral aspect, disposed in narrow spirals. Cœnnchyma thick. Spicules of polyp broad, warty, or thorny plates. Spicules of cœnenchyma warty spindles, often bent on long axis.

18. THESEA. Colony upright and branched, with a horny and calcareous axis. Polyps are slightly projecting and disposed on either side of flattened branches. Spicules are large, warty, scoop-shaped; superficial spindles with large warty knobs.

19. ACIS. Colony branched in one plane. Branches of same thickness throughout. Axis horny. Polyps small and placed at long intervals on sides of branches and twigs. Cœnenchyma a single layer of large spindles. Spicules are extraordinarily large, smooth or warty spindles with scales and disks on the polyps.

22. EUMURICEA. Colony branched. Polyps tubular warts, exhibiting an 8-rayed figure when retracted. Spicules elongated, sharp-pointed spindles.

23. MURICEA. Colony branched. Axis horny. Polyps cylindrical, calciferous, cup edges bilabiate or circular, disposed irregularly. Cœnenchyma thick. Spicules short, thick, spiny and warty spindles and clubs.

Family IX. PLEXAURIDÆ.

1. *Eunicea* Lamouroux.
2. *Plexaura* Lamouroux.
3. *Plexauroides* Wright & Studer.
4. *Plexaurella* Kolliker.
5. *Pseudoplexaura* Wright & Studer.
6. *Euplexaura* Verrill.
7. *Psammogorgia* Verrill.
8. *Eunicella* Verrill.
9. *Platygorgia* Studer.

1. EUNICEA. Colony arborescent, trunks cylindrical, branches free, not forming broad plates. Axis horny. Polyp cup edges bilobed or crenate. Polyps disposed over whole surface of colony on verruciform or papilliform, rather prominent tubercles. Cœnenchyma thick or moderately so. Spicules leaf-like or thorny clubs. On inside large warty spindles and smaller spindles, either of which may be red, violet, or colorless.

2. PLEXAURA. Colony arborescent, trunks cylindrical and free. Axis horny. Polyps scattered over whole surface of colony, sunken entirely or nearly so into cœnenchyma. Cup edges smooth or slightly crenate. Cœnenchyma very thick and corky. Spicules are club-shaped or spinose spindles.

4. PLEXAURELLA. Colony arborescent. Trunks cylindrical. Axis horny and calcareous. Branches free. Polyps as in *Plexaura*. Cœnenchyma usually very thick, thin in *P. phillipinensis* Wright & Studer. Spicules are tripartite and quadripartite and simple and leafy clubs.

5. PSEUDOPLEXAURA. Colony feebly branched. Axis horny, with central calcareous portion. Polyps close together in a somewhat close spiral, completely retractile. Cœnenchyma thick; outer layer soft and friable, inner layer contains numerous light purple or violet irregularly stellate spicules. Spicules of outer layer are spiny spindles with numerous pink stars and a few leafy clubs.

6. EUPLEXAURA. Colony closely resembles *Plexaura*. Polyps are larger, numerous, and completely retractile. Cœnenchyma dense and granular. Spicules for the most part short, stout, blunt, warty spindles of rather small size, with a few small double spindles and rarely small irregular crosses.

7. PSAMMOGORGIA. Colony upright, branched. Axis horny. Polyps scattered over surface, level with it or projecting in form of roundish warts. Cœnenchyma moderately thick. Surface finely granular, with small rough spicules. Spicules are short, thick, spiny, and warty spindles and warty clubs.

8. **Eunicella.** Colony flabelliform, branched dichotomously or palmate. Axis horny. Polyps scattered, raised on verrucæ or flat. Cœnenchyma thin or moderately thick. Spicules small, warty, double spindles. External layer of small clubs perpendicular to surface.

9. **Platygorgia.** Colony upright, branched. Axis horny, flattened. Branches flattened in plane of ramification. Calices sunken into cœnenchyma and do not project. Spicules a cortical layer of small clubs; under these, thick warty spindles.

Family X. GORGONIDÆ.

1. *Platycaulos* Wright & Studer.
2. *Lophogorgia* Milne-Edwards.
3. *Leptogorgia* Milne-Edwards, emend. Verrill.
4. *Stenogorgia* Verrill.
5. *Callistephanus* Wright & Studer.
6. *Swiftia* Duch. & Mich.
7. *Gorgonia* Linneus, emend. Verrill.
8. *Eugorgia* Verrill.
9. *Danielssenia* Grieg.
10. *Xiphigorgia* Milne-Edwards.
11. *Hymenogorgia* Valenciennes.
12. *Phycogorgia* Valenciennes.

3. **Leptogorgia.** Colony varies much in form, generally ramified more or less in one plane. Axis horny. Branches often anastomose, forming a net-like structure. Polyps usually in two lateral rows, having between them naked cœnenchyma. Polyps sometimes form short verrucæ and sometimes are completely retracted into cœnenchyma. Spicules are minute double spindles of varying length.

4. **Stenogorgia.** Colony branched. Axis horny. Polyps project from surface, retractile, disposed in two rows or scattered. Polyps bent inward when at rest. Cœnenchyma thin. Spicules small warty spindles. On surface a few short, irregular, rough, granular spicules, not forming a complete layer.

6. **Swiftia.** Colony upright, branched. Axis horny, calcareous. Polyps within verrucæ, at either side of branches. Spicules of cœnenchyma are scales; of polyp tentacles are spindles.

7. **Gorgonia.** Colony upright, varies much in form. Axis horny. Branches sometimes anastomose, sometimes plume-like. Polyps project more or less, disposed in two rows on either side of branches and twigs. Spicules are spindles and scaphoid forms.

10. **Xiphigorgia.** Colony more or less branched. Trunks cylindrical. Axis horny. Branches much compressed, forming wave-like longitudinal ridges of cœnenchyma. Polyps in rows on ridges of cœnenchyma. Spicules like those of *Gorgonia*.

11. **Hymenogorgia.** Colony ramified in one plane, upright, of a leaf-like appearance. Axis horny. Branches sometimes coalesce. Polyps scattered over face of expanded folia, not on edges. Cœnenchyma forms a continuous sheath over whole axis and its ramification.

12. **Phycogorgia.** Axis horny, divided into a number of thin leaf-like expansions. Polyp openings sunk within cœnenchyma Cœnenchyma overlays the thin expansions of axis.

Family XI. GORGONELLIDÆ.

1. *Nicella* Gray.
2. *Scirpearia* Cuvier, emend. Studer.
3. *Scirpearella* Wright & Studer.
4. *Juncella* Val., emend. Studer.
5. *Ellisella* Gray, emend. Studer.
6. *Verrucella* Milne-Edwards.
7. *Gorgonella* Milne-Edwards.
8. *Ctenocella* Val.
9. *Phenilia* Gray.
10. *Heliania* Gray.

4. **Juncella.** Colony simple or branched. Polyps sometimes small and disposed in two lateral rows, sometimes with well-developed, elongated verrucæ. Cœnenchyma thick. Spicules simple and double clubs in external layer.

6. **Verrucella.** Colony branched. Axis lamellar and calcified. Verrucæ wart-like, on summits of which bases of tentacles form an eight-rayed operculum. Spicules of cœnenchyma beset with roundish and conical warts, double spindles, and simple spindles.

8. **Ctenocella.** Colony branched in one plane, with branches on upper side only of stem. Polyps short, disposed on two sides of twigs. Cœnenchyma has distinct median furrows. Spicules warty double clubs.

DESCRIPTIONS OF PORTO RICAN ALCYONARIA.

Telesto riisei (Verrill.) Fig. A.

(*Clavularia riisei* Duch. & Mich.)

Several specimens of this species are among the collection, all preserved in alcohol. The general form of the colony is that of an erect, sparingly branched, white tubular stem, having the polyps arranged in irregular, somewhat alternating series, strongly projecting from the axial surface, and at distances from each other of from 3 to 6 mm. The color of the stem is white, that of the calicles a sort of dirty brown. The stems are further marked by a series of eight longitudinal ridges, not easily distinguished except by rather careful inspection with a lens. A similar character is distinguishable upon the calyces.

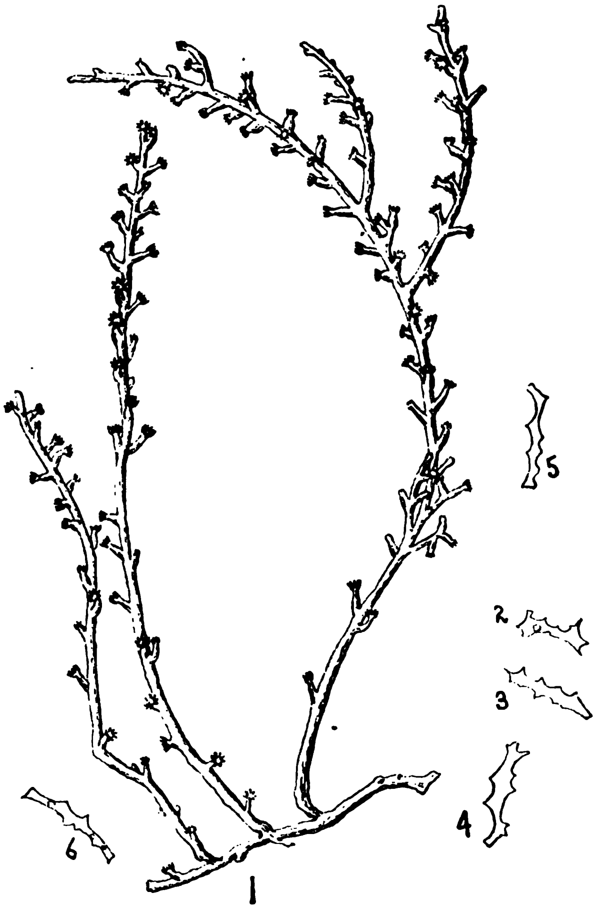

FIG. A.—(1) Colony of *Telesto riisei*, nine-sixteenths natural size.
(2-6) Spicules of same, magnified.

From stations 6072 and 6074, at depths of 7¼ and 6½ fathoms. Bottom shelly and with coral sand. Fig. A shows the general aspects of the colony, the creeping base, form of budding, etc., spicules closely interlaced, forming a definite tubular skeleton, which remains intact even after digestion in hot caustic potash.

Spongodes portoricensis Hargitt, new species. Fig. B.

The collection contained a single specimen of this genus, which, though somewhat fragmentary, is in general form and characteristics distinctively a *Spongodes*. While corresponding in many respects to several of Kukenthal's species, the character and size of the spicules seem clearly to indicate a new species. And while the fragmentary condition of the specimen renders difficult any conclusive determination of this point, I am strongly convinced of its specific distinctness, and would propose the name *portoricensis* as signalizing both the place of its occurrence and the first record of a member of the genus from Atlantic waters, and specially from a West Indian habitat. Its occurrence here is particularly interesting in this last respect, as extending the range of the genus and at the same time locating it in an environment in many ways similar to that of its Pacific relatives.

Height of colony, or fragment, about 45 mm. Color (alcoholic), a somewhat dirty white.

The specimen is densely spinose throughout, the spicules of relatively large size. In comparison with measurements of species of Kukenthal, Alcyonaceen von Ternate, and May, Alcyonaceen, Jenaisch. Zeitsch., March, 1899, there are very few species indeed ranging as large as the present. Polyp spicules, 0.22–0.72 mm. long; polyp stalk, 1.68–2.05 mm.; upper stem, 0.94–3 mm.; lower stem, 1.36–2.45 mm.

Taken at station 6063, from a depth of 75 to 76 fathoms by trawl. Bottom rocky, sand, and coral. The depth is greater than any of Kukenthal's species, except [illegible], and *collaris*, taken at Kei Island from a depth of 140 fathoms.

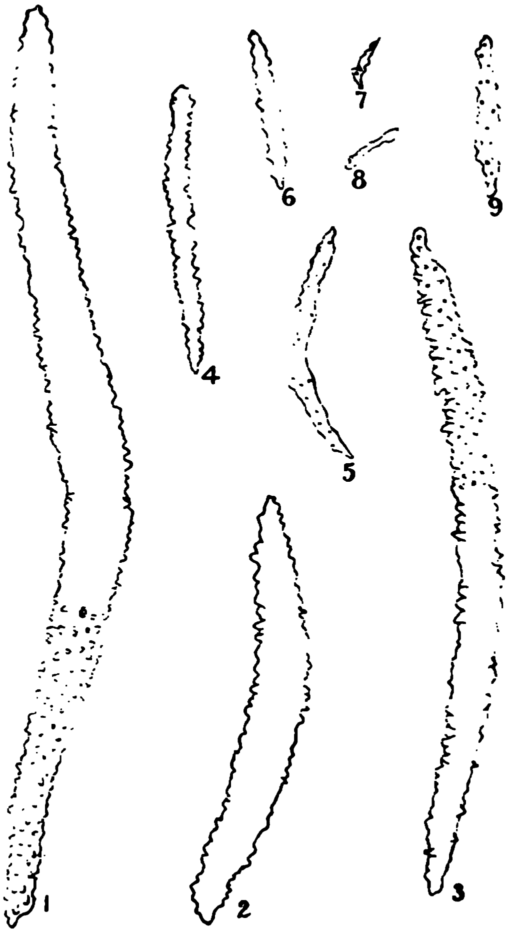

Fig. B.—Sp[illegible]

Renilla reniformis (Cuvier).

(*Pennatula reniformis* Pallas, 17[illegible]. [illegible] Lamarck, 1816. *R.* [illegible] Agassiz, 18[illegible].)

The collection contained but a single specimen of this very common species. *R.* [illegible] forms one of the highest of the Alcyonaria. It is a colonial organism, having the form of a reniform disk with a deep sinus at one side and borne upon a rather flexible peduncle, which is loosely attached to the sandy substratum upon which it grows. The polyps are arranged in a somewhat radial manner over the upper surface of the disk, but project almost horizontally from its margin, where new polyps constantly bud out.

Color of specimen (alcoholic), a dark purplish tint, polyps white.

From Mayaguez Harbor.

Solanderia nodulifera Hargitt, new species. Fig. C.

[illegible]

Of this genus two imperfect specimens were contained in the collection. The one here considered measured 125 mm. in height, somewhat arborescent, though sparingly branched. The main stem measured 5 to 6 mm. in diameter, the branches from 2.5 to 4 mm.

In color (alcoholic) the surface was of a dull yellow, mottled by purplish red where the low, noduliferous calyces are located. The spongy axial portion clearly locates the specimen among the *Briaraceæ*, and while there is some doubt as to its exact genetic affinities, they seem from the relations of the nutrient canals and form of spicules most closely allied with *Solanderia*, and I have so referred it, though in specific character it does not conform to either *gracilis* of Milne-Edwards or to *verrucosa* or *frauenfeldii* of Kolliker. I incline to regard it as a new species, and propose for it the name *S. nodulifera*, on account of the nodular form of the calicles and of many of the spicules as well. So far as is known no reports of its occurrence in West Indian waters have hitherto been made.

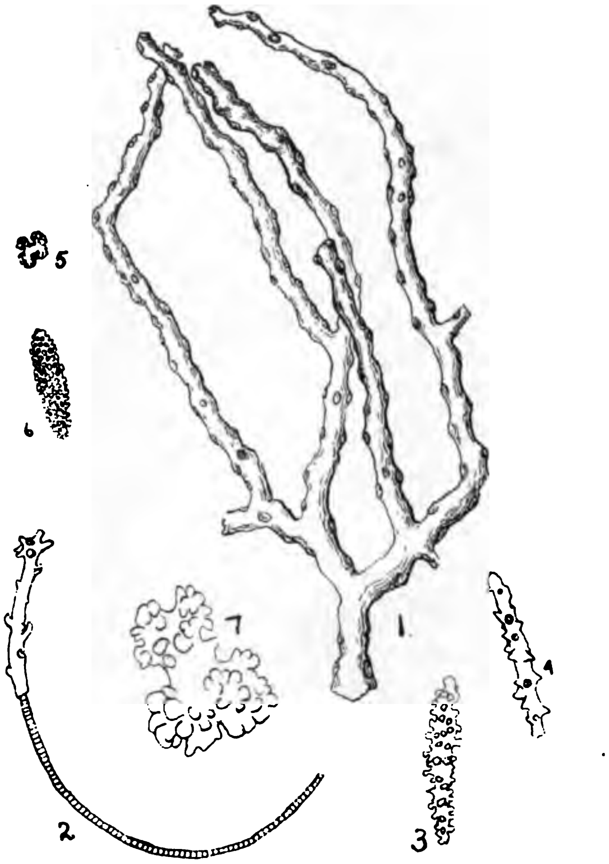

FIG. C.—(1) Colony of *Solanderia nodulifera*, natural size. (2) Colony of *S. crustata*, natural size. (3) to (5) Spicules of *S. nodulifera*, × 60. (6) Yellow spindle. (7) Small red spicules of *S. crustata*, × 360.

Spicules of two types. An attenuate, warty, red variety making up most of the axis, and a yellow attenuate spindle form comprising most of the rind portion. Spicules yellow, 0.26 mm.; red tuberculate, 0.36 mm.; red spiny, 0.37 mm.; small short, 0.06 by 0.048 mm.

From station 6079, off St. Thomas; 20 to 23 fathoms; coral bottom; taken with tangle.

Solanderia crustata Hargitt, nov. sp. Fig. D.

The second specimen is of a somewhat unique character, best illustrated in Fig. C, showing the general aspect of the colony and a cross section of the same. The specimen seems to be an incrusting species, somewhat similar in form to Studer's genus *Suberia*, though of a character more like that of *Anthothela* Verrill. When first examined the general aspect and hollow axis gave the impression of a *Kophobelemnon*, but a critical examination showed the spicular and structural character of a *Solanderia*, to which, with some hesitation, it is here referred. It has seemed that the horny, tubular support is but the secretion of the colony about a foreign stem, which had either disintegrated and fallen away or from which the dredge had withdrawn it in the capture. In size and form the spicules indicate its close genetic relations with *Solanderia*, and in the color, texture, etc., the colony is very much like the previous species. With these probabilities in view the specific name *crustata* is here proposed as indicative of the habit, if such should prove characteristic of the species.

Station 6064, Mayaguez Harbor; depth, 22 to 33 fathoms; sand and mud; taken by dredge.

Spicules tuberculate, 0.18 mm.; spiny spindle, 0.23 mm.

Chrysogorgia desbonni Duchassaing & Michelotti. Plate I, figs 1 to 5.

This beautiful colony is flabellate, usually branching in single plane. In the specimen under consideration there is a division near the base into two branches of about equal size. These subdivide and branch in a perfectly similar way, forming two parallel fan-shaped forms. In size the specimen measured 100 mm. in height by about 110 mm. in breadth, base not present. The axis is horny and somewhat calcareous, black and very hard. Cœnenchyma thin and white (alcoholic) and contains oblong and fusiform warty spicules. Cf. fig. Calicles rather large, somewhat scattered, and standing almost at right angles to the axis. Spicules, large, thorny spindle, 0.53 mm.; irregularly warted, 0.27 mm.; thorny, 0.20 to 0.24 mm.

A single specimen taken by trawl from station 6070; depth, 220 to 225 fathoms; rocky bottom; January 21, 1899.

Primnoa pourtalesii Verrill. Fig. D.

Only a small fragment of a single specimen of this species is contained in the collection, but sufficient to clearly establish its identity. Specimen about 50 mm. in height, with alternating branches in same plane about 3 to 5 mm. apart. Only the slightest indications of the zigzag aspect of the main stem mentioned by Verrill, though larger specimens would probably show this more clearly. Both stem and branches bear calicles on opposite edges in close rows, slightly alternating or almost opposite. They are beautifully covered with series of imbricating scales, the terminal ones, eight in number, forming a sort of operculum, being triangular in shape. The color is white (alcoholic), axis light amber, or straw color. Spicules in Fig. D.

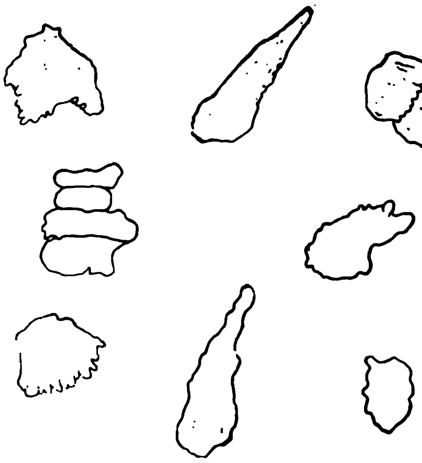

FIG. D.—Spicules of *Primnoa pourtalesii*, × 40.

Acanthogorgia aspera Pourtalès. Plate I, figs. 6–12.

In height the colony is about 300 mm., sparingly and unequally branched in a somewhat flattened plane. Axis dark and horny. Cœnenchyma thin, filled with elongate, fusiform spicules which project from the surface, giving it a very rough appearance. Calyces elongate, about 2 mm. by 1.2 mm. thick, somewhat constricted near summit, which is enlarged and furnished with sharp, slender, divergent spicules. See plate I, figs. 6–12. Spicules, oral, 0.717 to 1.04 mm.; stem, 0.647 to 0.68 mm.; quadripartite, 0.21 by 0.24 mm. to 0.20 by 0.34 mm.

A single specimen from station 6070, at a depth of 220 to 225 fathoms, from rocky bottom; taken by trawl, January 21, 1899.

Paramuricea hirta? Pourtalès. Fig. E.

In height the specimen is about 80 mm. by about 55 mm. broad, grayish white (alcoholic), much branched, flabellate in form, the smaller branches at various angles, surface rather rough, granular. Calicles rather prominent, 1 to 1.5 mm. in length by 0.75 mm. in diameter. Cœnenchyma thin, filled with various-shaped warty and spinulose spindle-shaped spicules, often curved. Axis dark, horny, cylindrical.

Not having access to the original description of this species there is some doubt as to its exact identification, though it would seem to be more nearly allied to this than to other described species. In case it should become necessary to give it specific separation I would propose the name *spinulifera*.

A single specimen, not perfect, from station 6067; depth, 97 to 120 fathoms; coral bottom; dredge, January 20, 1899.

Muricella megaspina Hargitt, nov. sp.

A small fragment of a single specimen in the collection has characters much resembling those of the genus *Muricella*, namely, the general form of the colony, thin cœnenchyma, small verrucæ, large spiny and warty spindles, the larger measuring from 2 to 3 mm. in length. It would also seem to have affinities more or less close with *Acis*, chiefly, however, in the size and disposition of the spicules. In the numerous calyces, and their oblique aspect upon the stem and branches, it seems, however, quite unlike the typical *Acis*. The verrucæ arise from the axis of stem and branches, not at right angles, as seems to be the more common form for this genus, and are covered with a series of much smaller spiny and somewhat warty spindles which cover the apex of the calicles, forming a hoodlike covering. In height the fragment is about 70 mm. The axis is horny, light brown to almost white in the terminal branches, very flexible. Cœnenchyma very thin, almost wholly comprised of a layer of large spindle-shaped spicules arranged horizontally longitudinally over the axis. Color of specimen (alcoholic) white, spicules all colorless. It would seem to be specifically distinct, the very large size of its spicules alone being sufficient to justify specific separation. I would therefore propose for it the name *megaspina*.

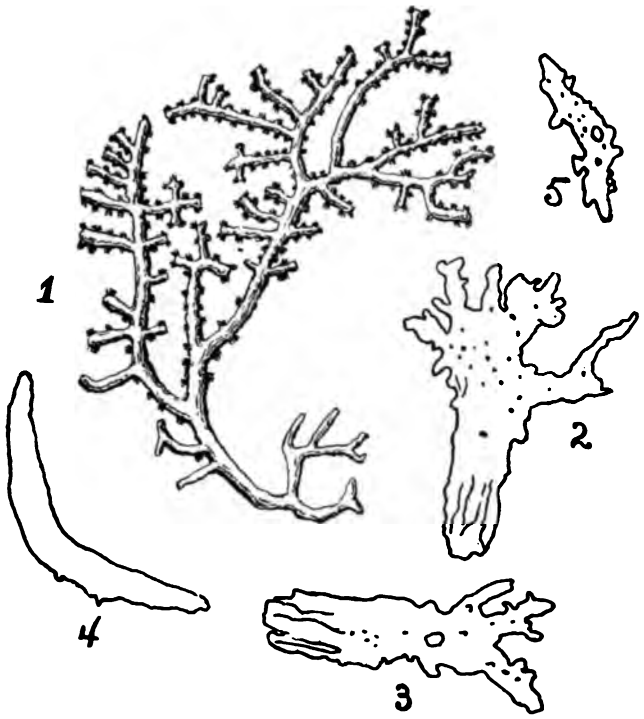

FIG. E.—(1) Colony of *Paramuricea hirta*, nat. size. (2-5) Spicules of same, × 75. (2, 3) Leafy clubs from stem. (4) Spindle from calicle.

Muricea flexuosa Verrill. Fig. F.

Lissogorgia flexuosa Verrill.

A single specimen preserved in alcohol. Colony branched, flabelliform, branches somewhat pinnate, slender. Axis horny, dark brown, flexible. Cœnenchyma thin, packed with large spindle-shaped spicules. Calicles verruciform, rather uniformly distributed over surface. Height of colony about 90 mm. by about 40 mm. broad. Color dull grayish white. Spicules large, 0.59 by 0.21 mm., 0.58 by 0.17 mm.; violet, 0.28 by 0.07 mm.

Taken at station 6077, off Gallardo Bank, by tangle; depth, 11½ fathoms; coral sand bottom.

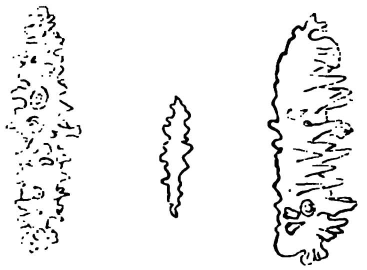
FIG. F.—Spicules of *Muricea flexuosa*. × 55.

Eunicea rousseaui Milne-Edwards.

Plate III, fig. 1.

A single specimen, incomplete. Colony somewhat arborescent, the branches tending to occupy a common plane. Entire colony heavy; the branches thick and somewhat club-shaped. Specimen about 200 mm. in height. Diameter of branches, 10 to 16 mm. Axis horny and rather massive, of a dark-brown color, almost black, and somewhat flattened in plane of colony. Calicles very prominent, the outer lip projecting into a horn-like hook, upper lip almost lacking. Cœnenchyma thick and densely packed with massive tubercular spicules, varying from 0.5 to 2.5 mm. in length by 0.2 to 0.6 mm. in diameter. Besides the larger ones of the cœnenchyma there are smaller, club-shaped ones lying just beneath the ectoderm and others of a pale purplish color about the axis.

Plate III, fig. 1, will afford a good general idea of the colony as a whole.

Eunicea crassa Edwards & Haime. Plate II.

Eunicea turgida Ehr.; *Plexaura turgida* Verrill.

Several specimens of this species were in the collection, all dry. The colony is large, somewhat dichotomously branched, the branches long, of fairly uniform diameter throughout, and tending to occupy a common plane. Height of colony from 300 to 500 mm. by about half as broad. Diameter of branches, 8 to 15 mm. Cœnenchyma thick, suberous, hard. Calices rather evenly distributed over entire surface, forming rather prominent oval cups with slightly raised border. Polyps retractile, the tentacles showing plainly within the calices. Spicules of some three distinct types: (1) Large, heavy, tuberculate spindles 1.34 to 1.8 mm. long; (2) smaller spinose spindles 1 mm. long; (3) very small purplish, and white, tubercular spindles, 0.1 to 0.13 mm. long.

This species would seem to be identical with Verrill's *Plexaura turgida*, but in its general aspects and the character of its spicules it seems distinctively Eunicean, and I have so designated it.

Plate II, figs. 1-9, will afford a good general impression of the character of colony and spicules.

Eunicea lugubris Duch. & Mich. Plate II.

A single specimen from Mayaguez Harbor. The colony is arborescent, arising from a single massive base and short, thick stem; but the latter soon becomes lost in its numerous branches, which form a dense cluster resembling somewhat a madrepore coral. Entire colony about 400 mm. in height; color dark brown or nearly black. Diameter of stem at base 22 mm.; branches 5 to 8 mm., including the elongated calicles. Axis black, horny, very hard and tough. Cœnenchyma thick, suberous, and somewhat friable. Plate II, fig. 10, gives a general impression of the appearance of the colony.

Eunicea laxispina Milne-Edwards. Fig. G.

Gorgonia [illegible] Lamk.; *Eunicea [illegible]* Lamx.; *Gorgonia papillosa* Dana.

A single specimen, somewhat imperfect. Colony sparingly branched, rising from a calcareous base. Height of colony about 150 mm. Calicles very prominent and scattered rather sparsely over the surface, the larger having a length of about 4 mm. by 2 mm. in diameter. Diameter of main stem from 3 to 4 mm. Color in alcohol, pale brown or yellowish. Cœnenchyma moderately thick, rather suberous in texture. Axis horny, dark brown in color, lighter in terminal portion. Spicules of two rather distinct kinds: (1) Large, white tuberculate spindles, 1 to 2.15 mm. in length; (2) small, spinose, and tuberculate spindles, of violet color, from 0.09 to 0.20 mm. in length.

Fig. G shows the general characteristics of the colony.

Taken with tangle, at station 6090; coral bottom, depth of 16 fathoms.

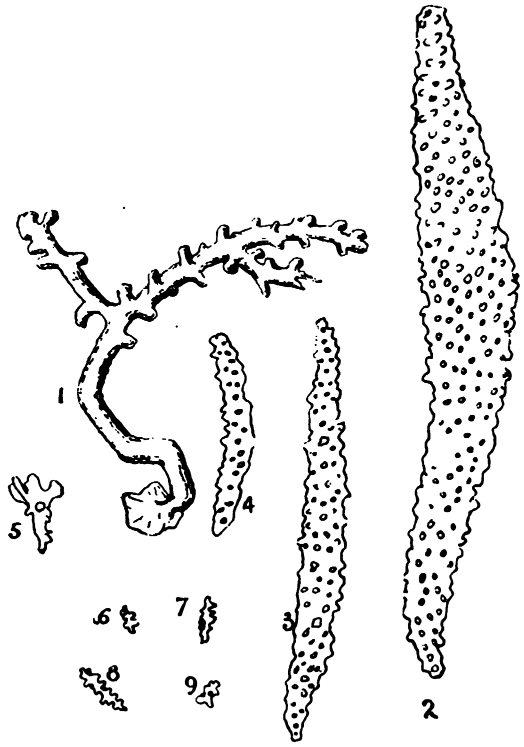

FIG. G.—Colony of *Eunicea laxispina*, $\frac{9}{16}$ natural size. Figs. 2–5 White spindles of outer layer. Fig. 2, Spindles 2.14 × 0.209 mm. Fig. 3, 1.35 × 0.145 mm. Fig. 4, 0.654 × 0.10 mm. Fig. 5, Club, 0.20 × 0.04 mm. Figs. 6, 7, 8, 9, Violet spicules of inner layer, 0.009 to 0.02 mm. long.

Plexaura flexuosa Lamouroux. Plate IV.

(*Eunicea furcata* Ehr., 1834; *Gorgonia anguiculus* Dana, 1846; *Plexaura rhipidalis* Val., 1855; *P. salicornoides* Milne-Edw., 1857.)

Two specimens of this species in the collection are quite typical, both as to size and form, and also as to the variation so characteristic of the species. From examination of a considerable collection in the National Museum, I am able to verify Verrill's note on this point (cf. Bull. Mus. Comp. Zool., vol. I, p. 35): "This species varies greatly in form, color," etc.

Colony shrubby or arborescent, branching and sub-branching rather freely, and with a tendency to occupy a common plane. Height 250 to 300 mm. Stems cylindrical, from 5 to 8 mm. in diameter. Axis horny, black, very hard, cylindrical. Cœnenchyma rather thick and densely packed with spindle-shaped spicules of some three types: (1) Large, white, tubercular; (2) small, purplish, spinose forms surrounding the axis; (3) very minute, somewhat clavate, spicules close beneath the ectoderm.

Color of dry specimens vary from dull chocolate brown to purplish.

Figs. 13 to 16, plate IV, give a good general idea of the form of the colony, as well as of typical spicules.

Plexaura homomalla Lamouroux Fig. H.

(*Gorgonia homomalla* Esper

Several specimens of this species were contained in the collection, all of the same general size and character. Color of dry specimens mostly black or very dark brown. Like the preceding species, the colonies branch profusely, with slight tendency to occupy a common plane. The branches arise obliquely from the base, but soon become vertical, the whole colony having a height of from 250 to 350 mm., with an almost equal breadth. The axis and cœnenchyma are quite similar in character to the former species, though the size of stem and branches average somewhat smaller. The calicles present some differences. In *P. flexuosa* they are wholly included, and leave pit-like depressions, which thickly cover the entire surface. In *P. homomalla*, while the calicles are also included and very numerous and evenly distributed, they do not present the pit-like depressions of the former, but often have a definite raised border or edge.

Fig. H shows characteristics of colony and of spicules.

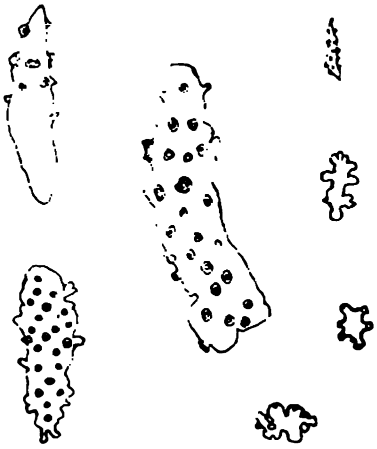

FIG. H.—Spicules of *Plexaura homomalla* magnified.

Plexaura crassa (Verrill.

(*Gorgonia crassa* Ellis & Solander; *Gorgonia porosa*, Esper. *Plexaura porosa*
E & H.

Colony arborescent, about 300 to 400 mm. in height. Branches not numerous, but somewhat extended in common plane. The specimens are dull yellow to light chocolate brown, dry. Axis horny, black, hard. Cœnenchyma moderately thick, very friable, the surface thickly and rather uniformly covered with the pore-like calicles, which are oval in outline, and, as in *P. flexuosa*, are definitely depressed below the surface. Of the exact specific relations of the specimens there is some little doubt.

Plate IV, figs. 1 to 12, show general features of colony and also of the spicules.

Plexaurella dichotoma Dana.

(*Gorgonia dichotoma* Esp., *G.* [illegible] Lamk., *G. heteropora* Lamx.; *Plexaura heteropora*, Lamx.; *G. crassa* Dana
[illegible] E. & H

An incomplete colony only was contained in the collection. Stem from 12 to 20 mm. in diameter, branches smooth, somewhat club-shaped. Color of dry specimen light brown or clay color.

Of this very common and well-known species it is not deemed necessary to give figures of either colony or spicules.

Leptogorgia solitaria Hargitt, nov. sp.? Fig. K.

In the collection were several specimens which in general aspects quite closely resembled the descriptions and figures of *Xiphigorgia setacea* E. & H. They were, however, very much shorter, and wholly devoid of the purplish border given for that species. The specimens were rather slender and ribbon-like in shape, with polyps arranged in a row along each margin of the stem and quite close together. In color (alcoholic), they were white, with a brown, horny axis, the whole somewhat flattened, as shown in Fig. K, 2.

The colony measured from 100 to 170 mm. by about 3 to 3.5 mm., and is wholly devoid of branches. It would seem to arise from a somewhat fleshy creeping disk, but while several portions of the base, or what appeared such, were contained with the specimens in the bottle, having young polyps growing upon them, there was not a single one with a definite stem attached, the latter apparently having been detached in the process of dredging. The spicules, which are typical Leptogorgian, vary in form and size; one an attenuate, highly tuberculate spindle 0.12 to 0.16 mm. long by 0.03 to 0.05 mm. thick, the other scaphoid in shape and 0.11 to 0.13 mm. long by 0.04 to 0.06 mm. thick.

In some respects the specimen here described resembles Pourtales's description of *Acis solitaria*, Bull. Comp. Zool., vol. I, p. 132; but the spicules are neither large nor scale-like. Not having access to Pourtales's specimens or figures, I am unable to infer whether he might have confused the spicules of some other form; the relative size, form, color, etc., being so closely similar to those under consideration as to suggest the possibility of such confusion. In case such were true, then his *Acis* should become *Leptogorgia;* if otherwise, I should propose that the present specimens be christened *L. solitaria.*

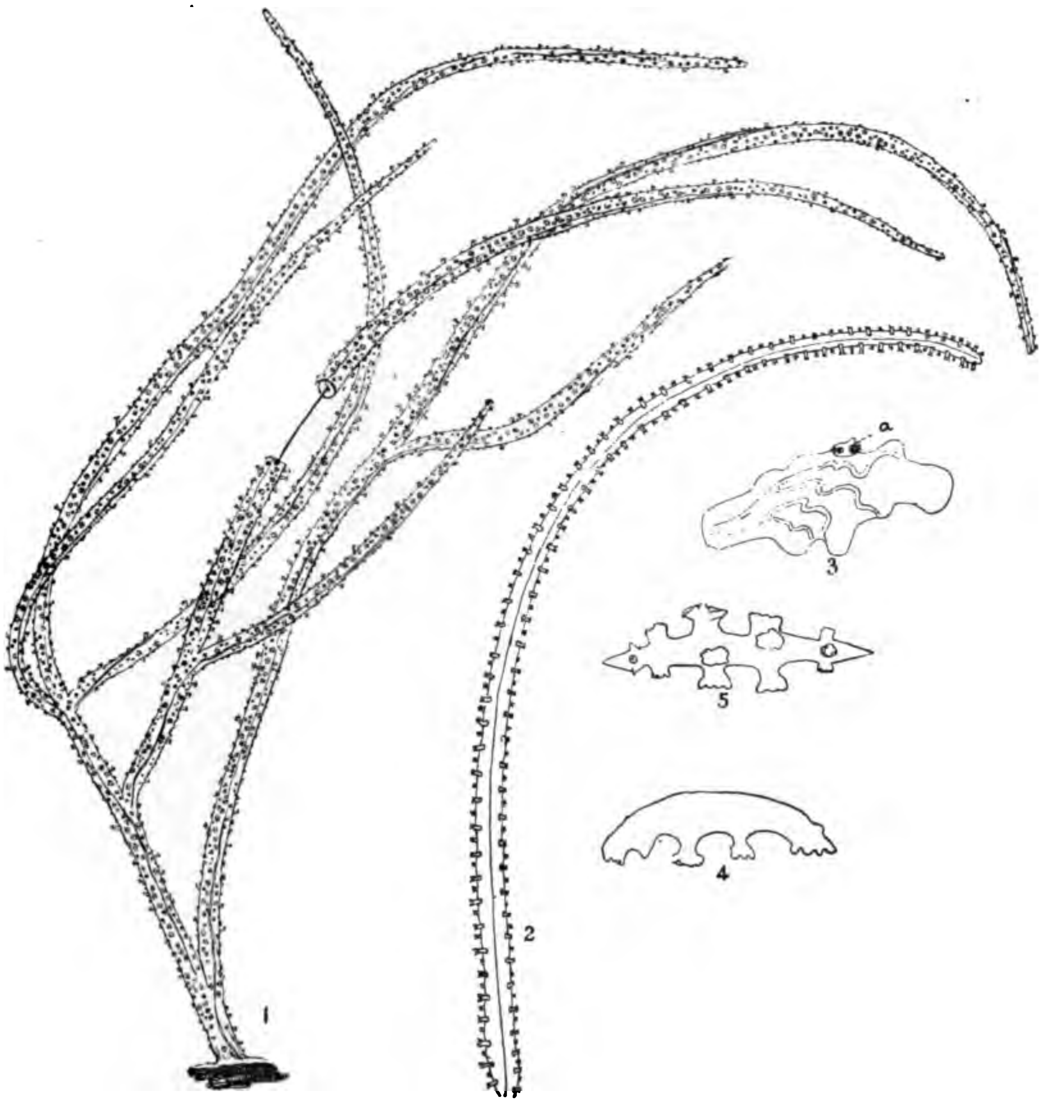

Fig. K.—(1) A colony of *Leptogorgia virgulata*, one-third natural size. (2) A colony of *L. solitaria.* (3) Portion of base, with single polyps at *a*. (4 and 5) Spicules of *L. solitaria*, greatly magnified.

Leptogorgia, sp. ?

Only a very small fragment of a single specimen, evidently of this genus, was contained in the collection, too small to warrant any definite determination of its specific affinities, though its spicules in general form and size would seem to identify it with *L. floridana* or *L. hebes.* Color, brick red. Taken at station 6062, Mayaguez Harbor, January 20, 1899, by means of dredge, from a depth of 25 to 30 fathoms. Bottom sand, mud, and shells.

Leptogorgia virgulata E. & H. (Fig. K. 1.)

Among a collection of Alcyonaria obtained by Mr. George M. Gray were specimens of this genus, probably identical with *L. virgulata* E. & H. The specimens are from Jamaica, but no data as to depth, bottom, or time were available. Its occurrence is therefore merely mentioned as a matter of incidental interest. Fig. K. 1. shows the general aspects of the colony.

Gorgonia acerosa Pallas. Plate III. fig. 2.

Pterogorgia acerosa Ehr.

Of this species the collection contained several fine specimens, all preserved dry. They varied in size from 35 to 80 cm. in height. The colonies are completely branched and panicled, the branches regularly pinnate, rather long, slender, and flexible. The colonies are light yellowish straw colored. This is one of the finest of the Gorgonias, and is well represented in Plate III. fig. 2. These, with other species of *Gorgonia*, *Plexaura*, and *Eunicea*, were taken from comparatively shallow waters in the bay of Mayaguez, though no specific data are furnished with the dry specimens.

Gorgonia flabellum Linn. Plate III. fig. 3.

Rhipidogorgia flabellum Valenciennes.

Several fine specimens of this species were taken in the same locality as the last, varying in height from 30 to 60 cm. and in width from 20 to 40 cm. The form is typical flabellate, the branches reticulate and coalescent in the most intricate way, with open meshes of fairly similar size and form. Occasionally accessory branches or colonies arise from the otherwise plane surfaces and grow into structures quite similar to the mother colony, which is distinctively fan-shaped, whence the popular term "sea fans," by which they are commonly known. Color in general yellowish brown, varying in places to purple.

Gorgonia bipinnata Verrill.

Pterogorgia bipinnata Verrill.

In height the specimens measured 110 and 350 mm., respectively, by about 60 to 150 mm. in width. They are of characteristic flabelliform shape, branches twice pinnate and somewhat coalescent. Color white (alcoholic), with black, horny axis showing through the rather thin cœnenchyma. Spicules. Roughly tuberculate spindles. Plate III. fig. 4, affords a good general impression of the colony as a whole.

Taken at stations 6079 and 6088, by the tangle from depths of 20 to 23 fathoms, February 6, 1899.

Antipathes tristis Duchassaing.

A single specimen of this species was taken at station 6070, at a depth of 220 to 225 fathoms, from rocky bottom, by means of the trawl. While not now generally recognized as a true Alcyonarian, it may be briefly described in this connection. The specimen is about 15 cm. in height. Polyps closely contracted upon rather slender branches, having a somewhat spiral arrangement upon the stem. The spines are sharp, triangular, quite as figured by Pourtales (Bull. Mus. Comp. Zool., vol. VI. No. 4).

SYRACUSE UNIVERSITY, *September 1, 1900.*

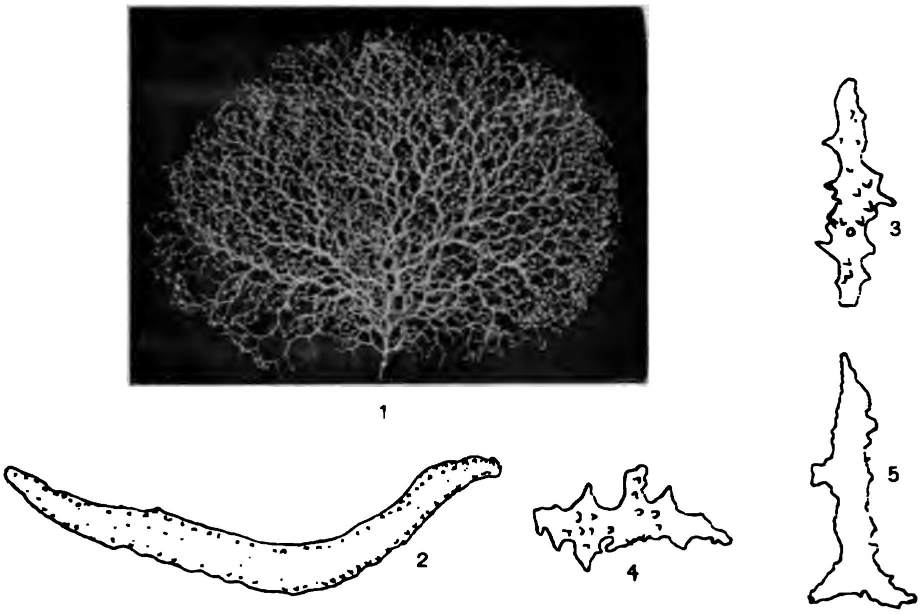

FIG. 1, COLONY OF CHRYSOGORGIA DESBONNI. FIGS. 2 TO 5, SPICULES OF SAME X ABOUT 120.

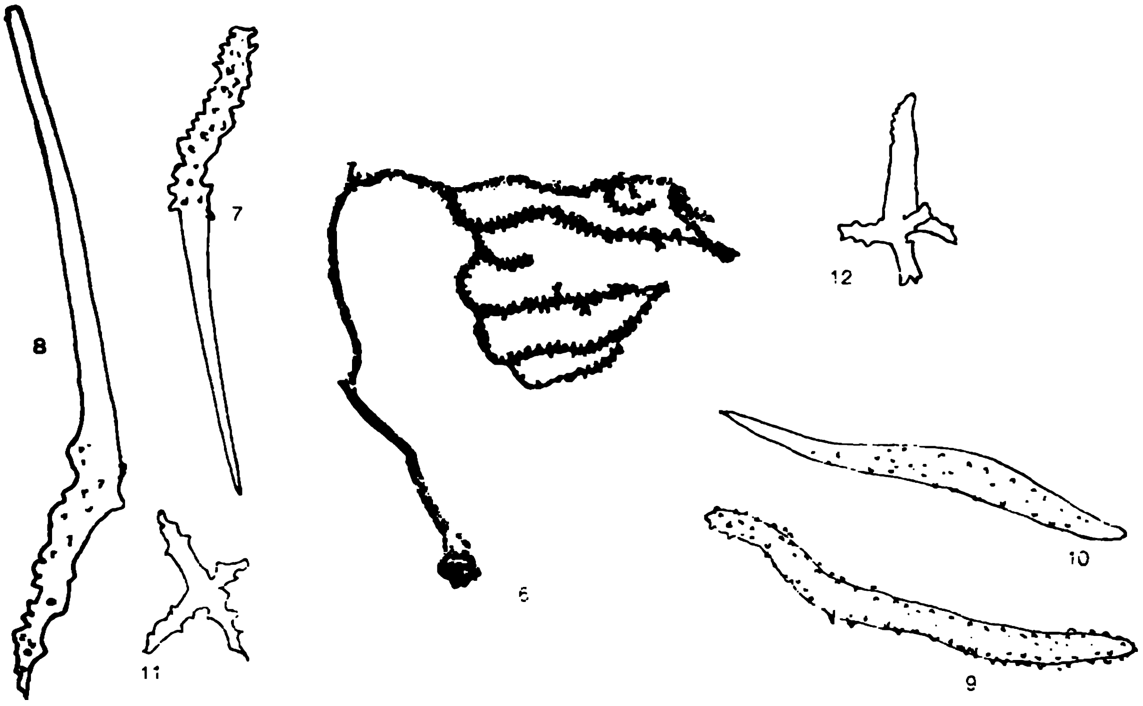

FIG. 6, COLONY OF ACANTHOGORGIA ASPERA. FIGS. 7, 8, ORAL SPINES OF SAME, 0.717 TO 1.04 MM IN LENGTH. FIGS. 9 TO 12, STEM SPICULES, 0.68 MM; 0.64 MM; 0.21 X 0.24 MM; 0.34 X 0.20 MM, RESPECTIVELY

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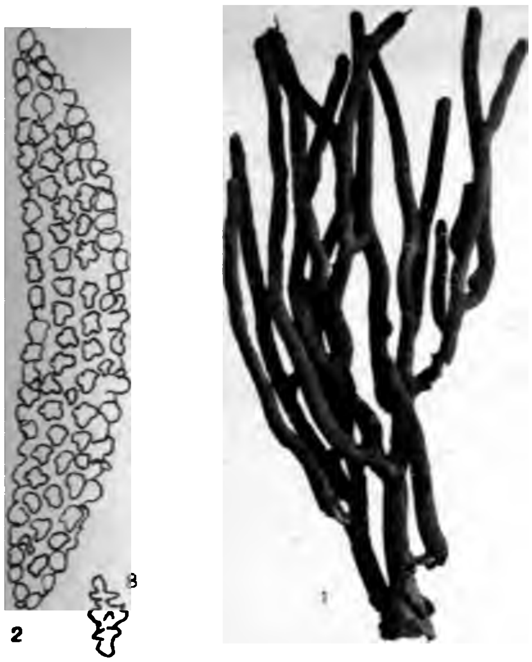

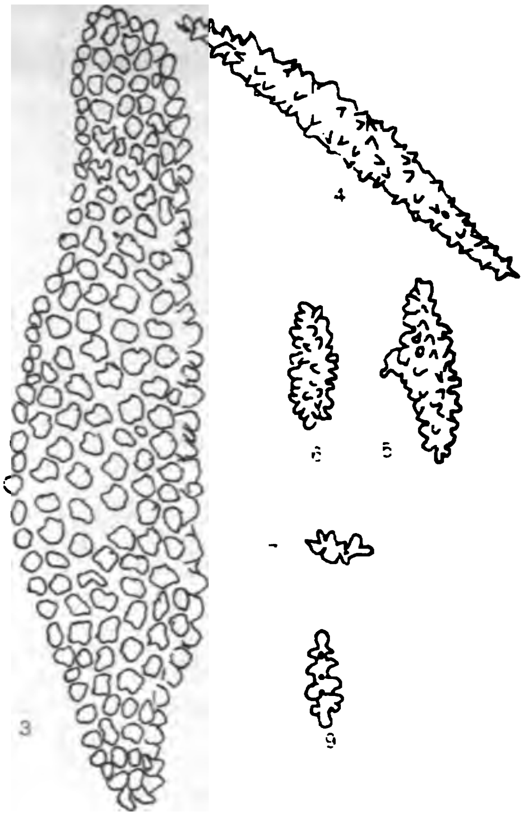

FIG. 1, COLONY OF EUNICEA CRASSA. FIG. 2 TO 9, SPICULES OF SAME. FIG. 2, 1.34 X 0.20 MM; FIG. 3, 1.80 X 0.39 MM; FIG. 4, 1.0 X 0.125 MM; FIGS. 5 TO 6, PALE VIOLET SPINDLES OF INNER LAYER, 0.31 TO 0.43 MM. LONG; FIGS. 7, 8, 9, VIOLET SPINDLES, 0.16 TO 0.22 MM. IN LENGTH.

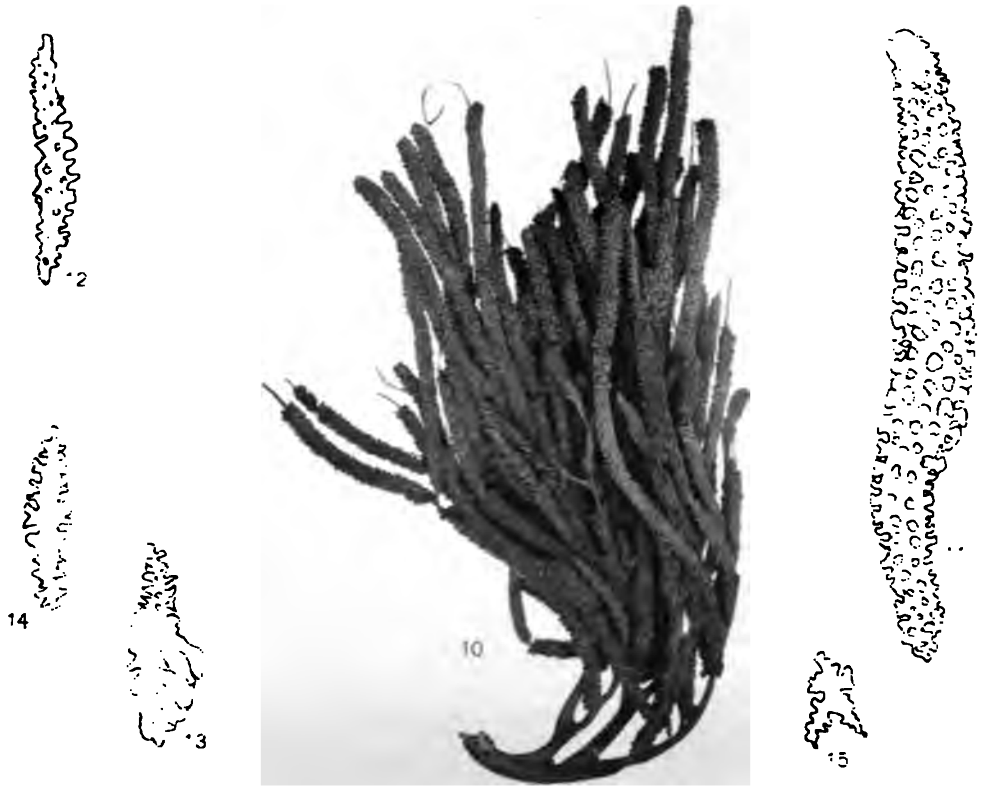

FIG. 10, COLONY OF EUNICEA LUGUBRIS. FIGS. 11, 12, TUBERCULATE SPINDLES OF OUTER LAYER, X 75. FIG. 13, CLUB FROM OUTER LAYER, 0.35 X 0.15 MM; FIGS. 14, 15, RED SPICULES FROM INNER LAYER, 0.3[illegible] AND 0.16 MM. LONG

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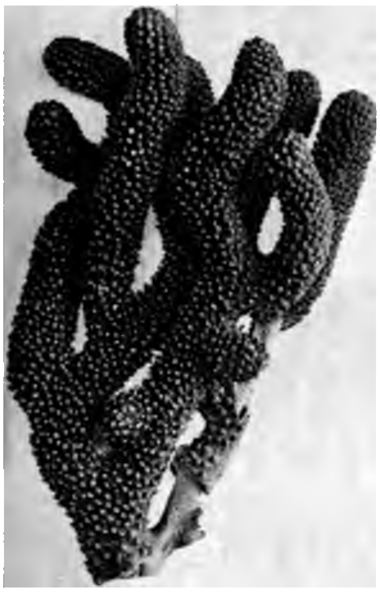
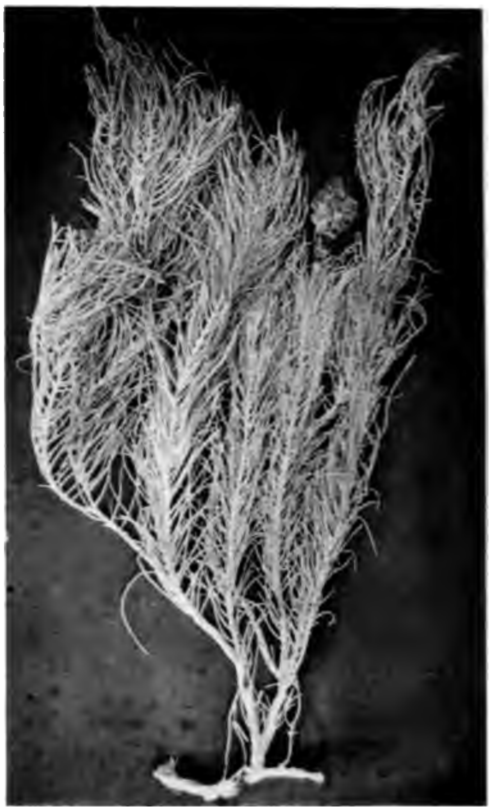
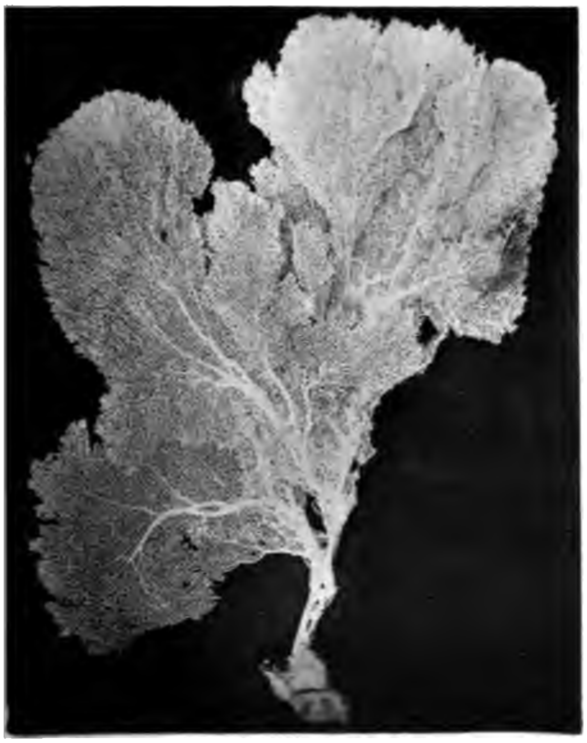


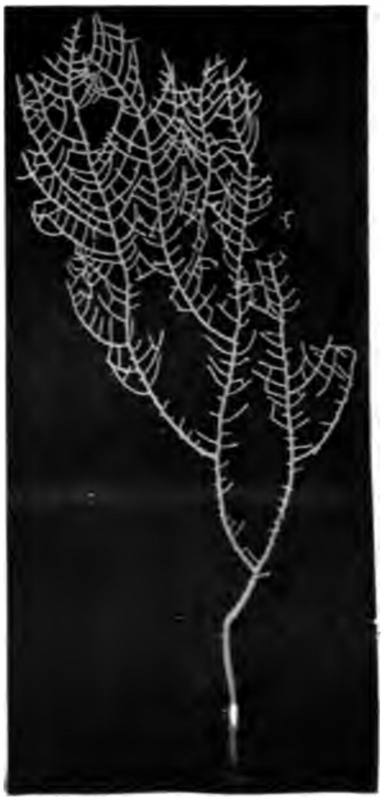
1. COLONY OF EUNICEA ROUSSEAUI.



2. COLONY OF GORGONIA ACEROSA.



3. COLONY OF GORGONIA FLABELLUM.



4. COLONY OF GORGONIA BIPINNATA.

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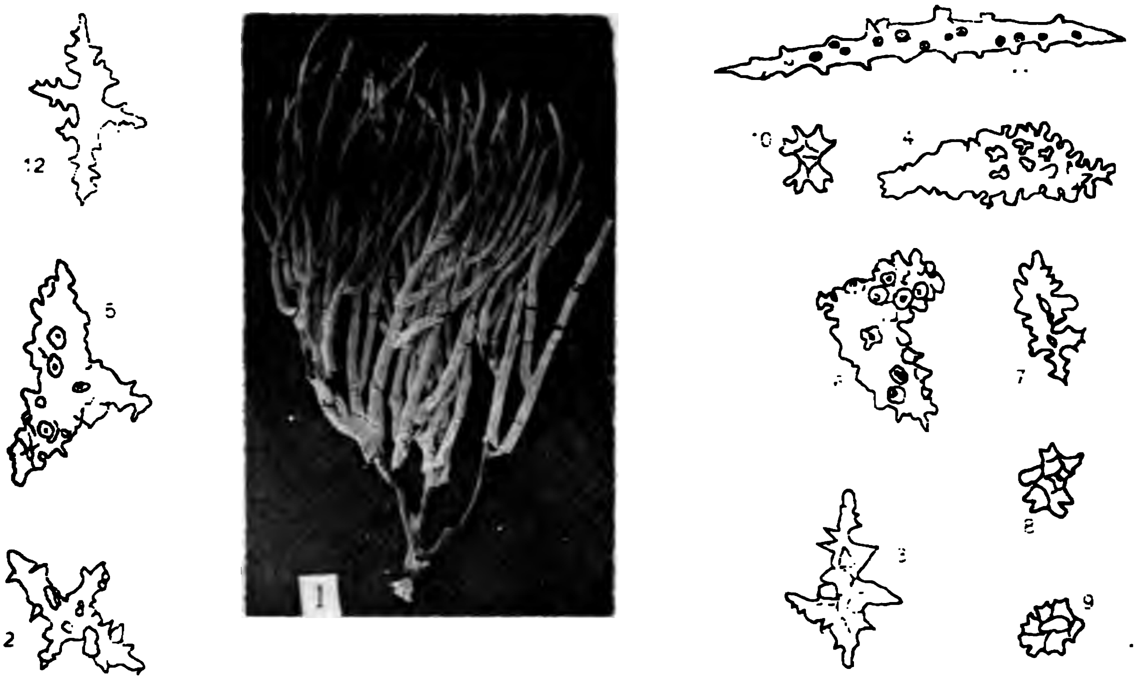

FIG. 1, COLONY OF PLEXAURA CRASSA. FIGS. 2 TO 12, SPICULES OF SAME. FIG. 2, WHITE, 0.36 × 0.17 MM; FIG. 3, 0.34 × 0.219 MM. FIG. 4, 0.469 × 0.149 MM. FIG. 5, 0.45 × 0.25 MM; FIG. 6, 0.34 × 0.24 MM. FIG. 7, 0.265 × 0.117 MM. FIG. 8, 0.14 × 0.117 MM. FIG. 9, RED, 0.13 × 0.09 MM. FIG. 10, RED, 0.125 × 0.09 MM. FIG. 11, WHITE, 0.72 × 0.1 MM. FIG. 12, RED, 0.33 × 0.19 MM;

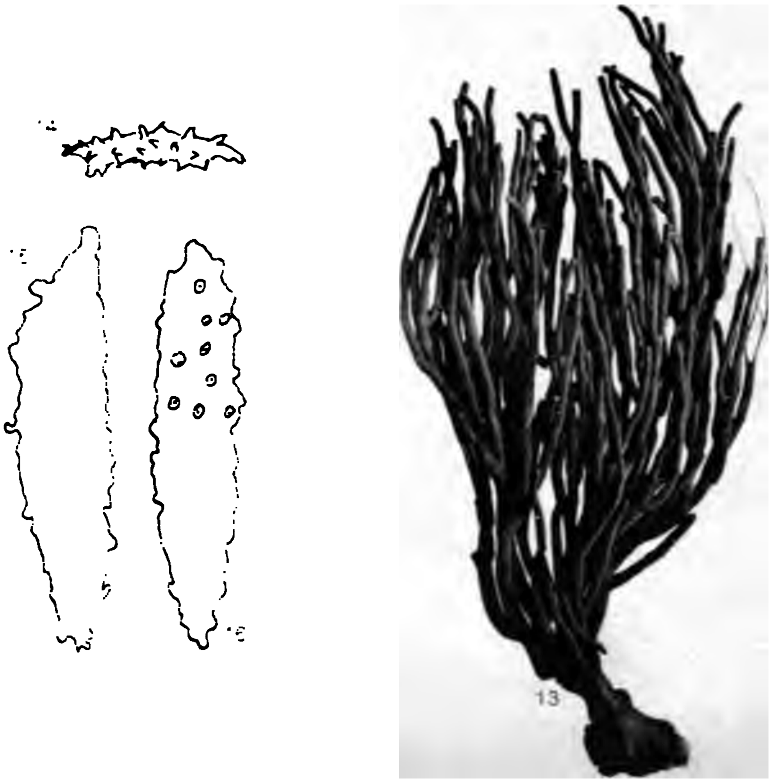

FIG. 13. COLONY OF PLEXAURA FLEXUOSA. FIG. 14, RED THORNY SPINDLE, 0.36 × 0.093 MM; FIG. 15, RED WARTY SPINDLE, 0.86 × 0.20 MM; FIG. 16, WHITE WARTY SPINDLE, 0.83 × 0.19 MM.

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THE STONY CORALS OF THE PORTO RICAN WATERS.

BY

T. WAYLAND VAUGHAN.

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THE STONY CORALS OF THE PORTO RICAN WATERS.

By T. WAYLAND VAUGHAN.

INTRODUCTION.

In the following account of corals collected around Porto Rico by the U. S. Fish Commission steamer *Fish Hawk* during the expedition of 1898–1899, I have used a considerable part of a paper written for the Royal Leyden Geological Museum, entitled "Some Fossil Corals from the Elevated Reefs of Curaçao, Arube, and Bonaire."[1] As that paper may not be easily accessible to all of those into whose hands the present one may fall, instead of referring to it, the necessary data are republished here.

My conclusions regarding synonymy may not meet universal agreement among students of zoophytes. The number of species recognized is very often a function of the amount of material studied. My guide in the separation of species has been the absence of intermediate forms, and from the study of enormous amounts of material I have felt justified in uniting previously characterized species to a greater extent, probably, than any other student of West Indian corals; but I have recognized that the species can often be divided into considerable numbers of *formae* or *varieties* and have correspondingly treated many of them. By means of the notes on the material from Porto Rico and the profuse illustrations, one should be able to know precisely what particular varieties or forms of the species have been collected and studied.

The following table gives the numbers of the stations at which the species were collected and the depth and character of the bottom:

Name.	Locality.	Depth (fathoms).	Bottom.
Caryophyllia berteriana Duchassaing?	Not given.		
Cyathoceras portoricensis, sp. nov	Station 6051	43	Sand, mud, shells.
Paracyathus de filippii Duchassaing & Michelotti	Stations 6082, 6075	8¼ to 30	Do.
Deltocyathus italicus (Michelotti)	Station 6067	97 to 120	Coral sand.
Oculina diffusa Lamarck, var	Stations 6087, 6092, 6097	10 to 16	Do.
Axhelia asperula (M.-Edw. & H	Station 6087	15¼	Do.
mirabilis (Duchassaing & Michelotti)	Station 6051	43	Sand, mud, shells.
Meandrina mæandrites (Linn.)? young	Stations 6080, 6087	15¼ to 20	Coral sand.
Cladocora arbuscula (Le Sueur)	Station 6087	15¼	Do.
debilis M.-Edw. & H	Not given.		
Astrangia solitaria? var. portoricensis, var. nov	Not given.		
astreiformis M.-Edw. & H	Station 6090	16	Coral sand.
Orbicella acropora (Linn.) var	Mayaguez		Reef.
Favia fragum (Esper)	Playa de Ponce		Do.
Manicina areolata (Linn.)	Ensenada Honda, Mayaguez, Aguadilla.		Reef.
Platygyra viridis (Le Sueur)	Mayaguez		Do.
Siderastrea radians (Pallas)	do		Do.
siderea (Ellis & Solander)	Culebra		Do.
Agaricia elephantotus (Pallas)	Station 6090	16	Coral sand.
Agaricia sp	do	16	Do.
cailleti (Duchassaing & Michelotti)	Station 6079	20 to 23	Do.
"Diaseris" crispa Pourtalès	Station 6069	223 to 231	Sand, mud.
Isopora muricata (Linn.) ss. (forma cervicornis Lam.)	Mayaguez, etc	to 10	Reef.
prolifera Lam	Culebra		Do.
palmata Lam	Mayaguez, Culebra		Do.
Porites porites (Pallas) forma clavaria Lam	Culebra, Ensenada Honda		Do.
furcata Lam	do		Do.
divaricata Le Sueur	Station 6087	15¼	Coral sand.
Porites astreoides Lamarck	Mayaguez, Culebra		Reef.
Millepora alcicornis Linn	do		Do.

---

[1] Samml. des Geologisch. Reichs. Museum, Leiden, ser. II, Bd. II, Heft 1, pp. 1–91, 1901.

In the arrangement of families I have followed Verrill quite closely, as his classification seems the most satisfactory in many respects. The new family names which are proposed are for the most part necessary changes of old names, his general scheme being followed.

The plates are from photographs by Mr. Levin C. Handy. The drawings for the other figures were made by Dr. J. C. McConnell and Miss Florence Wieser.

DISCUSSION OF SPECIES.

Class ANTHOZOA.

Order ACTINIÆ.

Suborder SCLERACTINIÆ.

Family CARYOPHYLLIDÆ Verrill.

Genus CARYOPHYLLIA Lamarck, 1801.

Caryophyllia berteriana Duchassaing?.

1850. *Caryophyllia berteriana*, Duchassaing, Anim. Rad. Ant., p. 15.
1868. *Caryophyllia formosa*, Pourtalès, Bull. Mus. Comp. Zool., vol. I, No. 6, p. 113.
1871. *Caryophyllia formosa*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 7, pl. I, fig. 16; also *C. berteriana?*, ibid, p. 8.
1874. *Caryophyllia berteriana*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. VIII, p. 32, pl. VI, figs. 1, 2.
1878. *Caryophyllia formosa*, Pourtalès, Bull. Mus. Comp. Zool., vol. V, No. 9, p. 199.
1880. *Caryophyllia berteriana*, Pourtalès, Bull. Mus. Comp. Zool., vol. VI, No. 4, pp. 96, 99.
1881. *Caryophyllia berteriana*, Moseley, Deep-Sea Corals, Challenger Reports, p. 134.

A single young specimen of a species of *Caryophyllia* was obtained. *C. berteriana* is apparently the only species to which it can be referred. The correctness of the identification is not quite positive, and therefore the name above is followed by a question mark. Locality not given.

Genus PARACYATHUS Milne-Edwards & Haime, 1848.

Paracyathus de filippii Duchassaing & Michelotti. Pl. I, figs. 1, 1*a*.

1861. *Paracyathus de filippii*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 60 (of reprint), pl. IX, figs. 2, 3.
1866. *Paracyathus de filippii*, Duchassaing & Michelloti, Sup. Mém. Corall. Ant., p. 65 (of reprint).
1869. *Paracyathus confertus*, Pourtalès, Bull. Mus. Comp. Zool., vol. I, No. 7, p. 134.
1871. *Paracyathus confertus*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 11, pl. VI, figs. 11, 12, 13.
1874. *Paracyathus de filippii*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. VIII, p. 38.
1878. *Paracyathus confertus*, Studer, Monatsber. Akad. Wissen. Berlin for 1877, p. 628.
1878. *Paracyathus de filippii*, Pourtalès, Bull. Mus. Comp. Zool., vol. V, No. 9, p. 200.
1880. *Paracyathus de filippii*, Pourtalès, Bull. Mus. Comp. Zool., vol. VI, No. 4, pp. 96, 105.
1881. *Paracyathus de filippii*, Moseley, Deep-Sea Corals, Challenger Reports, p. 144.

Two specimens of this common West Indian species were obtained from station 6062, Mayaguez Harbor, and station 6075, Boca Prieta, Point Guaniquilla. Both are young and neither is very good. Bathymetric occurrence, 8½ to 30 fathoms.

Genus CYATHOCERAS Moseley, 1881.

Cyathoceras portoricensis, sp. nov. Pl. II, figs. 1, 1*a*, 1*b*, 1*c*.

Corallum attached by a fairly large base, from which arises a rather long, thick, stout, bent pedicel. Calice elliptical in cross section. Greater diameter of calice, 9.3 mm.; lesser diameter of calice, 7.5 mm.; height of corallum, 22.5 mm.; greater distance across area of attachment, 7.5 mm.

There is no distinguishable epithecal coat on the outside of the corallum. Costæ correspond to all septa. Near the calice they are quite prominent and show three different sizes; a few millimeters below the calicular margin they are not prominent, being represented by granulations in rows very slightly or not elevated. The cycles of costæ may be indistinct or those corresponding to the first and second cycles of septa may be somewhat larger than those corresponding to the third and fourth.

There are four cycles of septa, in six systems. The members of the first and second cycles project considerably above the upper margin of the corallum wall, are nearly equal in size, those of the first cycle being slightly larger, and extend inward to the columella. The members of the third cycle are considerably smaller, and those of the fourth cycle are very small. The inner margins of the septa of these two cycles are free, i. e., no septal groups are formed. The septal margins are entire or microscopically dentate. The ornamentation of the septal faces consists of fine, more or less elevated striæ, along which granulations are arranged. The striæ diverge inwardly and outwardly from a vertical line corresponding in position with the wall. The striæ on one side of a septal face alternate with those on the opposite side, thus giving the edge of the septum a transversely zigzag character. The granulations on the septal faces are low, and besides being placed along the striæ are arranged in curves parallel to the septal margins. The inner margins of the septa fall perpendicularly to the bottom of the calice. There are no pali. No endotheca of any kind was observed, but the base of the corallum is filled up solidly with internal calcareous deposit.

The calicular fossa is deep and narrow. The columella, which projects somewhat in the bottom of the fossa, is well developed, is compressed elliptical in transverse outline, spongy, and apparently essential. It appears to be made up of several twisted ascending trabeculæ, that have fused one to another and to the inner ends of the first and second cycles of septa.

From station 6051, off entrance to San Juan Harbor, Old Fort SW. ¼ W., 1¼ miles. Bathymetric occurrence, 43 fathoms; bottom, sand, mud, and shells. Type, No. 19633, U. S. Nat. Mus.

I have been unable to find any description of a coral corresponding to this in the literature on the recent deep-sea corals, and therefore propose a specific designation. In view of the great amount of study that has been put on the West Indian deep-sea species by such excellent workers as Pourtalès and Moseley, it was a surprise to find a new species in the Porto Rican collection.

Moseley proposed the genus *Cyathoceras* for two species: *C. cornu*, from off the mouth of Rio de la Plata, 600 fathoms, and off Twofold Bay, New South Wales, 120 fathoms: and *C. rubescens*, off the Ki Islands, 129 fathoms. He remarks: "This genus is formed to receive two species which might be placed with *Desmophyllum* if they had not columellas in every respect resembling those of the *Caryophyllias*."[1] Before the specimen above described was cleaned I thought it was a *Desmophyllum*, and before I discovered there were no pali I thought it was a *Caryophyllia*. The present species is so distinct from each of those described by Moseley that there is no need to point out specific differences. It resembles more closely *C. rubescens* than *C. cornu*, but *C. rubescens* possesses five cycles of septa besides other differences.

I do not feel certain that *Cyathoceras* is entitled to hold rank as a good genus. It is extremely close to *Ceratotrochus*, as represented by *C. duodecimcostatus* (Goldfuss), the difference between the two genera consisting in *Ceratotrochus* having a pointed or small base, whereas *Cyathoceras* possesses a rather large base. Even if they should be united, they may for the present be kept separate.

Genus DELTOCYATHUS Milne-Edwards & Haime, 1848.

Deltocyathus italicus (Michelotti). Pl. I, figs. 2, 2*a*. (Copied from Lindström).

One dead, worn specimen of this species was obtained. It is the variety *calcar* of Pourtalès, possessing six horns corresponding to the six primary septa.[2]

From station 6067, Mayaguez Harbor. Bathymetric occurrence, 97 to 120 fathoms.

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[1] Deep-Sea Corals, Challenger Reports, Zool., vol. II, pt. VII, 1881, p. 156.

[2] Pourtalès, Bull. Mus. Comp. Zool., vol. VI, No. 4, 1880, p. 102, pl. I, fig. 5. Moseley, Deep-Sea Corals, Challenger Reports, p. 145, lower two figures, "Stellate variety of Pourtalès."

Family OCULINIDÆ Milne-Edwards & Haime.

Genus OCULINA Lamarck, 1816.

Oculina diffusa Lamarck ? var. Pl. I, figs. 5, *5a*.

1816. *Oculina diffusa*, Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 285.
1880. *Oculina diffusa*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, pl. III, figs. 10, 11, 12.

A number of specimens of this species are in the collection from stations 6097, off Humaçao, village of Humaçao; 6087, off Culebra, Point Mula light-house; 6092, off Vieques Island, Culebritas light-house; 6093, off Culebra, Culebritas light-house. Bathymetric occurrence, 10 to 16 fathoms.

These specimens differ from the typical *diffusa* by having the branches more attenuate and more slender; one branchlet measures 2 cm. between bifurcations, and possesses a diameter of only 3 mm. The appearance of these specimens is so different from the usual *diffusa* of the Florida reefs that I at first thought them a distinct species, but a study of the splendid suites of specimens in the United States National Museum has caused me to believe that they may be only varieties of the same thing. I doubt very much if *Oculina pallens* Ehrenberg can be kept separate, in spite of what at first appear important differences. This suggestion is based upon studies of Ehrenberg's types and the material in the United States National Museum. The only difference between the Porto Rican specimens and *O. pallens* consists in the corallites of the latter being not so prominent as those of the former. The pali of the Porto Rican specimens are the same as in *O. pallens*. The same is true of the costæ. As yet I have not studied sufficient material to have a definite opinion about the relations of the species. The data preliminary to the revision of all the West India species of *Oculina* have been accumulated, but an opportunity for working them out has not yet come to hand.

Family STYLOPHORIDÆ Verrill.

Genus AXHELIA Milne-Edwards & Haime, 1849. (+ MADRACIS Milne-Edwards & Haime.)

Type species: *Axhelia myriaster* Milne-Edwards & Haime.
Type species of *Madracis: Madracis asperula* Milne-Edwarde & Haime.

1849. *Axhelia*, Milne-Edwards & Haime, Compt. Rend., t. XXIX, p. 69.
1849. *Madracis*, Milne-Edwards & Haime, ibid., t. XXIX, p. 70.
1861. *Reussia*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 63 (of reprint).
1871. *Pentalophora*, Saville-Kent, Proc. Zool. Soc. London for 1871, p. 283.
1884. *Madracis*, Duncan, Jour. Linn. Soc. Lond., vol. XVIII, p. 45.

I am unable to discover any criterional differences for the separation of *Axhelia* (subsequently spelled *Axohelia*) from *Madracis*. Milne-Edwards & Haime[1] in speaking of the species of *Madracis* state:

"Elles représentent dans cette division aberrante les *Axhelia*, de la famille des Oculinides, ayant des cloisons et une columelle à peu près semblables; mais leur cœnenchyme, quoique très dense, est d'une structure différente, et les chambres des polypiérites ne tendent pas à se remplir par l'envahissement du tissu mural."

The only tangible difference is, in *Axhelia* the visceral chambers fill up by the encroachment of the wall, while in *Madracis* "the chambers of the corallites do not tend to become filled by the invasion of the mural tissue," but this is weakly expressed. In young calices of *Axhelia* the visceral chambers are open, but they are filled in older calices. The figure of *Madracis asperula* given by Milne-Edwards & Haime are from a young specimen.[2]

Axhelia asperula (Milne-Edwards & Haime). Pl. I, fig. 4, and Pl. XVII, fig. 2.

1849. *Madracis asperula*, Milne-Edwards & Haime, *nom. nud.*, Compt. Rend., t. XXIX, p. 70.
1850. *Madracis asperula*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ième sér., Zool., t. XIII, p. 100, pl. IV, figs. 2, *2a*.
1857. *Madracis asperula*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 139.
1871. *Madracis asperula*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 27.
1880. *Madracis asperula*, Pourtalès, Bull. Mus. Comp. Zool., vol. VI, No. 4, p. 108.

Several specimens from station 6087, off Culebra, Point Mula light-house, agree with both the figures and the description given by Milne-Edwards & Haime, except that the calices are smaller, slightly less than 1.5 mm. in diameter. Bathymetric occurrence, 15¼ fathoms.

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[1] Ann. Sci. Nat., 3ième sér., t. XIII, 1850, p. 100.

[2] Ann. Sci. Nat., t. sup. cit., pl. IV, figs. 2, *2a*.

Axhelia mirabilis (Duchassaing & Michelotti). Pl. I, fig. 3, 3*a*.

1861. *Stylophora mirabilis*, Duchassaing & Michelotti. Mém. Corall. Ant., p. 62 (of reprint), pl. IX, figs. 6, 7.
1874. *Axohelia mirabilis*. Pourtalès, Ill. Cat. Mus. Comp. Zool., No. VIII, p. 41, pl. VIII, fig. 4.
1880. *Axohelia mirabilis*. Pourtalès, Bull. Mus. Comp. Zool., vol. VI, No. 4, p. 107.

A single specimen of this species was obtained at station 6051, off entrance to San Juan Harbor, in 43 fathoms of water.

Pourtalès has called attention to the specific identity of *Stylophora mirabilis* Duchassaing & Michelotti, *Stylophora dumetosa* Duchassaing, and what he had previously identified as *Axohelia myriaster* Milne-Edwards & Haime. He seemed doubtful concerning his own *Axohelia schrammi*.[1] We have good suites of specimens in the United States National Museum, so I do not hesitate to include *Axohelia schrammi* also in the synonymy of *mirabilis*. I can discover no criterional characters from the description or figure of *Ax. myriaster* by which the West Indian species can be separated from it. The branches may or may not be very coalescent. But as the original locality for *myriaster* is given as the East Indies, and as I have not studied the type, I have followed Pourtalès in giving the name *mirabilis* to this West Indian species. The *Axhelia decactis* (Lyman) is a different species. Some specimens in the United States National Museum from off Arrowsmith Bank, Yucatan, 130 to 167 fathoms, Cat. No. 10279, are interesting because they show on the same specimen both striate and echinulate cœnenchyma. The echinulations may be tall and coarse, or delicate.

The principal difference between the specimens here referred to *asperula* and those referred to *mirabilis* consists in the branches of the former being not so attenuate as those of the latter species.

Family EUSMILIDÆ Verrill.

Genus MEANDRINA Lamarck, 1801.

Type species: *Meandrina pectinata* Lamarck (= *Madrepora mæandrites* Ellis & Solander, Nat. Hist. Zooph., p. 161, tab. XLVIII, fig. 1).

1801. *Meandrina*. Lamarck, Syst. Anim. s. Vert., p. 372.
1815. *Pectinia* (pars). Oken. Lehrb. Naturgesch., p. 68.
1815. *Mæandra* (pars), Oken. op. cit., p. 70. pl. II, second column, bottom fig. (= pl. IV A, Esper, reduced).
1816. *Meandrina* (pars), Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 244.
1846. *Ctenophyllia*, Dana, Zooph. Wilkes Expl. Exp., p. 169.
1848. *Ctenophyllia*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ième sér., Zool., t. X, p. 276.
1851. *Pectinia*, Milne-Edwards & Haime, Arch. Mus. Hist. Nat., t. V, p. 56.
1857. *Pectinia*, Milne-Edwards & Haime. Hist. Nat. Corall., t. II, p. 206.
1884. *Pectinia*, Duncan, Jour. Linn. Soc. London, vol. XVIII, p. 86.
non
1820. *Meandrina*, Schweigger, Handb. Naturgesch., p. 420.
1846. *Meandrina*, Dana, Zooph. Wilkes Expl. Exped., p. 252.
1848. *Meandrina*, Milne-Edwards & Haime, Comptes Rendus, t. XXVII, p. 493.
1857. *Meandrina*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 388. Not *Mæandrina* of subsequent authors.

This name *Meandrina* has had a perplexing and exasperating history. When Lamarck proposed it, he included only one species in the genus, referring at the same time to a figure by Ellis & Solander; this species is *Meandrina pectinata* of Lamarck, the *Madrepora mæandrites* of Linnæus and of Ellis & Solander. This species is the type and it can not be supplanted by any other. In 1815 Oken proposed the name *Pectinia* for a genus in which he included two species, *Meandrina pectinata* and *Madrepora lactuca*. In the same work Oken used *Mæandra*, which was defined "Mündungen als Furchen vielfaltig hin und hergewunden wie hirnwindungen, unverzweigt, in Klumpen."[2] He included in the genus *M. areola* (=*Manicina areolata* (Linn.)), and *M. mæandrites*, which he divides into two varieties. (*a*) Gemeines Hirnkorall, *Matrepora mæandrites* Pallas, *labyrinthiformis* Linn. Blätter gezähneit. Das gewöhnliche, das man in Kabinetten antrifft." This is partly *Diploria labyrinthiformis*, but quite surely a considerable number of species are here confused. "(*b*) Irrgarten, *M. labyrinthiformis* Pallas, *mæandrites* Linn.; Blätter ungezähnelt. Sehr selten, Amerika, auch im Mittelmeer," u. s. w. This is *Meandrina mæandrites* (Linn.). "Hieher *Matrepora gyrosa*, *dædalea*, *natans*."

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[1] Bull. Mus. Comp. Zool., vol. VI, No. 4, 1880, p. 107.

[2] Lehrb. Naturg., p. 70.

The figure given by Oken, pl. II, second column, bottom figure, is a copy, somewhat reduced, of Esper's pl. IV A, which is *Madrepora mæandrites* Linn. = *Meandrina mæandrites* (Linn.). I think it best to consider the figured species as the type of the genus. This would make *Mæandra* Oken a synonym of *Meandrina* Lamarck. Lamarck in 1816 included nine species in his *Meandrina*, the last one being the *Madrepora filograna* of Esper (=*clivosa* of Ellis & Solander). Dana's *Ctenophyllia* covers precisely the same ground as Lamarck's original *Meandrina*. In 1848 Milne-Edwards & Haime, in the Ann. Sci. Nat., t. X, use *Ctenophyllia* for Lamarck's original *Meandrina* (following Dana), and in the Comptes Rendus, t. XVII, make *filograna* the type of *Meandrina*, i. e., they ignored the Système des Animaux sans Vertèbres of 1801, and selected as the type of the genus the last species referred to the genus in Lamarck's Histoire Naturelle des Animaux sans Vertèbres of 1816. In 1851, in their Polypiers des Terrains Paléozoïques, *Pectinia* of Oken replaces their previous *Ctenophyllia;* the same course is followed in the Histoire Naturelle des Coralliaries in 1857.

The type of *Meandrina* being fixed, we can make disposition of the other names. First, as to *Pectinia*. Since two species were originally included in the genus by Oken, one of them must be the type. The species *pectinata* can not be the type, because it was already the type of *Meandrina;* therefore *lactuca* must become the type of *Pectinia*, and *Tridacophyllia* of Milne-Edwards & Haime must become a synonym of *Pectinia*. *Mæandra* becomes a synonym of *Meandrina*. *Ctenophyllia* is an exact synonym of *Meandrina*. A new name must be used for what Milne-Edwards & Haime have called *Mæandrina*. The name *Platygyra* of Ehrenberg,[1] which has not been used by subsequent authors, is available. This name is fully discussed later in considering the species referable to it.

These changes in the names are unfortunate, but they can scarcely be avoided. They may be summarized thus:

Present names.	Name used by Milne-Edwards & Haime, 1857.
Meandrina	Pectinia.
Pectinia	Tridacophyllia.
Platygyra	Mæandrina.

Meandrina mæandrites (Linn.)? Young. Pl. III; Pl. IV, fig. 1.

1758. *Madrepora mæandrites*, Linnæus, Syst. Nat., ed. x, p. 794.
1766. *Madrepora mæandrites*, Pallas (as applied to Seba, t. III, pl. CXI, fig. 8), Elench. Zooph., p. 292.
1766. *Madrepora labyrinthica*, Pallas (non-Linnæus), op. cit., p. 297. Synonymy given by Pallas, not of *Madrepora mæandrites* Linnæus.
1797. *Madrepora lamellosa*, Humphreys, Mus. Calonn., p. 66.
1801. *Meandrina pectinata*, Lamarck, Syst. Anim. s. Vert., p. 372.
1815. *Pectinia pectinata*, Oken, Lehrb. Naturgesch., p. 68.
1815. *Mæandra labyrinthiformis, b*, Oken, op. cit., p. 70.
1834. *Manicina pachyphylla*, Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 326.
1846. *Ctenophyllia meandrites*, Dana, Zooph. Wilkes Expl. Exp., p. 170, pl. XIV, fig. 13.
1846. *Ctenophyllia quadrata*, Dana, op. cit., p. 170, pl. XIV, fig. 14.
1851. *Pectinia mæandrites*, Milne-Edwards & Haime, Arch. Mus. Hist. Nat. Paris, t. v, p. 57.
1851. *Pectinia quadrata*, Milne-Edwards & Haime, op. sup. cit., p. 57.
1861. *Pectinia disticha*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 66 (of reprint). pl. IX, fig. 16.
1861. *Pectinia elegans*, Duchassaing & Michelotti, op. sup. cit., p. 66.
1861. *Pectinia caribæa*, Duchassaing & Michelotti, op. jam cit., p. 67.
1890. *Manicina areolata*, A. Agassiz, Bull. Mus. Comp. Zool., vol. XX, No. 22, pl. III. Non *Manicina areolata* (Linn.).

Ctenophyllia profunda and *pachyphylla* Dana (1848) probably should be included in the above synonymy. Twelve species of *Meandrina* (*Pectina* auct.) have been described or named, viz, *mæandrites* by Linnæus; *lamellosa* by Humphreys; *pectinata* by Lamarck; *pachyphylla* by Ehrenberg; *quadrata* and *profunda* by Dana; *brasiliensis*, *danæ*, and *sebæ* by Milne-Edwards & Haime; *disticha*, *elegans*, and *caribæa* by Duchassaing & Michelotti. My study of the synonymy of *mæandrites* has resulted in the identical conclusion of Gregory, except that I have also included Dana's *profunda* as questionable.

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[1] Corallenth. Rothen Meeres, p. 323.

The West Indian species of *Meandrina* may be divided into two sections, typified by the mode of multiplication of the valleys. Milne-Edwards & Haime recognized these characters, as their descriptions show, but they did not give them the importance that should be attached to them. The valleys in the *mæandrites* section are usually arranged in a recognizably radial manner, radiating outwardly from the center of the upper surface of corallum (the valleys may be irregularly arranged). The other section is typified by *M. brasiliensis*. In transverse outline the corallum is elliptical and there is often or usually a valley zigzagging along the longer transverse axis or parallel to it. The shorter valleys run perpendicularly outward from the longer transverse axis. This mode of growth is similar to that of *Manicina areolata*.

The granulations on the faces of the septa and the septal dentations in *Meandrina brasiliensis* are coarser than in *Meandrina mæandrites*. These differences are very striking when the specimens are compared side by side. Pourtalès many years ago called attention to the dentation of the septal margins of "*Pectinia*" *mæandrites*.[1] The dentations are small but perfectly distinct.

The following species are included in *Meandrina mæandrites*: *lamellosa* Humphreys; *pectinata* Lam. (an exact synonym); *pachyphylla* Ehrenberg (also an exact synonym, the type was examined by me in the Museum für Naturkunde at Berlin); *quadrata* Dana; *disticha*, *elegans*, and *caribæa* Duchassaing & Michelloti. The types of Duchassaing & Michellotti's species were studied in Turin. Their *Pectina quadrata* and *P. elegans* are the same thing. The width of the valleys is from 13 to 15 mm. The specimen called *P. quadrata* often has the walls of adjoining series separated, or there may be a depression along the summit of the colline where the two walls come together; in other instances the fusion of the walls of the adjoining series is complete. In *P. elegans* the fusion is more often complete than in the former. I could find no basis for even varietal separation. The *disticha* and *caribæa* are the same, except for some difference in the shapes of the colonies. The valleys in *disticha* are from 8 to 9 mm. wide, in *caribæa* 8 to 10. They are narrower than in the specimens called *quadrata* and *elegans*. A specimen in the U. S. National Museum, from Belize, Honduras (A. E. Morlan, collector), has valleys 7, or less, to 15 mm. wide and 8 or 9 mm. deep. Two specimens, also in the U. S. National Museum, from the Caloosahatchie Pliocene of Florida, show about the same variation. *Ctenophyllia profunda* Dana is placed questionably in the synonymy of *mæandrites*. Dana's description is not sufficient to base a positive opinion upon, and I have not seen the type.

Pectinia sebæ Milne-Edwards & Haime seemed to be based upon Seba's pl. CVIII, figs. 3 and 5, and Ellis & Solander's pl. LI, fig. 1 (Lamouroux, Exp. Méth., also pl. LI, fig. 1). All of these figures appear to me to be *Colpophyllia gyrosa*.

Pectinia danæ (Milne-Edwards & Haime) groups with their *brasiliensis*. The salient distinguishing features are, *danæ* possesses an epitheca; the costæ are distinct only above it, where they project but little. The costæ of *brasiliensis* consist of rows of tall, distinct, separated granulations.

The result of the study of the species of *Meandrina* is to recognize in the Caribbean and Brazilian regions two species, viz. *M. mæandrites* and *M. brasiliensis*. "*Pectinia sebæ*" is a doubtful species, as is also *profunda* of Dana. The locality of *danæ* is unknown, but is probably from the Caribbean Sea.

Two young specimens which appear to be *M. mæandrites* were collected, but neither shows the typical specific characters. The larger specimen (pl. III, and pl. IV, fig. 1) is 79 mm. long, 40 mm. wide, and 36 mm. high. There is one main valley parallel to the greatest length of the specimen, and subsidiary valleys are forming on each side. The form resembles that of *Pectinia danæ* Milne-Edwards & Haime very closely. (See pl. V.) The second specimen is 35 mm. long, 16 mm. wide, and 22 mm. high. It is a simple coral, with one straight valley. These specimens are interesting, as they show what the young of *Meandrina mæandrites* probably is.

Photographic reproductions of the type of *Pectinia danæ* are given, pl. V, for the purpose of comparison. The photographs were sent through the kindness of Prof. Edmond Perrier of Paris. I do not consider the Porto Rican specimens to be the same species as *Pectinia danæ*, because the formation of subsidiary valleys begins earlier in the former, and the costæ of *danæ* show small spines above the epitheca and just below the calicular edge.

From station 6080, off St. Thomas, Sail Rock; station 6087, off Culebra, Point Mula light-house. Bathymetric occurrence, 15½ to 20 fathoms.

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[1] Ill. Cat. Mus. Comp. Zoöl., No. IV (Mem., vol. II), 1871, p. 68.

Family ASTRANGIDÆ Verrill.

Genus CLADOCORA Ehrenberg, 1834.

Cladocora arbuscula (Le Sueur). Pl. II, figs. 3, 3*a*.

1820. *Caryophyllia arbuscula*, Le Sueur, Mém. Mus. d'Hist. Nat., Paris, t. VI, p. 275, pl. XV, fig. 2.
1834. *Cladocora cæspitosa*, var. β, *microstoma*, p. 310, and *Cladocora candelabrum*, p. 311, Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, pp. 310, 311.
1857. *Cladocora arbuscula*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 595.
1861. *Cladocora unipedalis*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 79 (of reprint), pl. X, figs 5, 6.
1866. *Cladocora parvistella*, Duchassaing & Michelotti, Suppl. Mém. Corall. Ant., p. 91 (of reprint), pl. X, figs. 1, 2.
1880. *Cladocora arbuscula*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, pl. III, figs. 1–7.

A large number of specimens of this species was collected at station 6087, off Culebra, Point Mula light-house, in 15¼ fathoms of water. The specimens are typical and show no noteworthy variations. A few notes on the synonymy of this species may be in place. Milne-Edwards & Haime (op. sup. cit.) have placed Ehrenberg's *Cl. cæspitosa* var. β and his *Cl. candelabrum* in the synonymy of *arbuscula*. I have studied Ehrenberg's types in the Museum für Naturkunde in Berlin and verified the reference of Milne-Edwards & Haime. The original specimens of three species of Duchassaing & Michelotti were studied in Turin. Their *Cl. arbuscula*, *conferta* (Dana's species), and *unipedalis* are the same species. The corallites in *Cl. conferta* are more crowded than is usual. The *Cl. parvistella* is placed in the synonymy of *arbuscula* from a study of their description and figures. The type was not found in Turin. The only character at all diagnostic given in the description is "calycibus * * * vix tribus millimetris latis," and that is the usual diameter of the calices in *arbuscula*, the measurement given by Milne-Edwards & Haime. This leaves *Cl. parvistella* without any basis for specific recognition.

Cladocora debilis Milne-Edwards & Haime.

1849. *Cladocora debilis*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ième sér., Zool., t. XI, p. 308.
1857. *Cladocora debilis*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 599.
1871. *Cladocora debilis*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 30.

One specimen, here referred to this species, was collected; the locality is not given. The specimen is in bad condition, being incrusted by *Serpula* tubes and nullipores. The calices are of about the same diameter as in *arbuscula*, but are much shallower and the pali are much more developed. The species is undoubtedly identical with specimens in the U. S. National Museum labeled *Cladocora debilis* by Dr. Rathbun. I can not feel sure that this species is really distinct from *Cl. arbuscula*. The essential differences consist in the calices of *arbuscula* being deeper and the pali much less developed than in *debilis*. These characters are subject to variation, and a more extensive study may necessitate the mergence of the two forms. Pourtalès has suggested that what he has identified as *Cl. debilis* may be only a deeper water variety of *Cl. arbuscula* (op. sup. cit.).

The other species of *Cladocora* from eastern America are: *Cladocora patriarca* Pourtalès, Brazil; *C. pulchella* Milne-Edwards & Haime, West Indies; *C. johnsoni* Gane, Pliocene of South Carolina; *C. jamaicaensis* Vaughan, Cretaceous of Jamaica. The *Cladocora conferta* (Dana) is a doubtful species. It possesses more septa than *arbuscula*.

Genus ASTRANGIA Milne-Edwards & Haime, 1848.

Astrangia solitaria (Le Sueur)? variety **portoricensis**, var. nov. Pl. I, figs. 6, 6*a*, 6*b*.

1820. *Caryophyllia solitaria*, Le Sueur, Mém. Mus. Hist. Nat. Paris, t. VI, p. 274, pl. XV, fig. 1.
1861. *Astrangia neglecta*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 79 (of reprint), pl. X, figs. 3, 4.
1861. *Astrangia granulata*, Duchassaing & Michelotti, ibid., p. 79, pl. IX, figs. 13, 14.
1871. *Astrangia solitaria*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 79.
1880. *Astrangia solitaria*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, No. 1, pl. XII, figs. 8–12.

The two specimens representing this variety are so different from the usual form of the species that I at first considered it a distinct species and drew up the diagnosis accordingly. A more detailed comparison has caused me to think that it may be only an aberrant variety of *A. solitaria*. The single corallite, taken as the type, will be described, and then a comparison will be made with the other specimen. This corallite is turbinate, 14 mm. tall; the greater diameter of the calice, 7 mm.; lesser, 6.5.

Externally ornamented by low, flat, equal, densely granulate costæ, which are distinct to the base; immediately below the calicular edge the costæ may be slightly prominent. There are 3 complete cycles of septa, and a fourth cycle is present in 9 of the 12 half systems. The members of the fourth cycle fuse to the sides of those of the third, and the members of the third fuse to those of the second. The first and second cycles reach the columella. None of the septa are very exsert. The members of the first cycle are slightly the most prominent; those of the second not quite so prominent as those of the first, and those of the fourth are the least prominent. The margins of the third and fourth cycles are dentate; those of the first cycle entire; the margins of all members of the second cycle are broken off. Pali exist before all septa, except those of the last cycle. Each one consists of a more prominent, erect, somewhat rounded tooth, with other similar teeth below, which are scarcely to be distinguished from papillæ on the upper surface of the columella. Columella, weak, spongy. Calicular fossa, deep, narrow at the bottom.

From Porto Rico; more definite locality not given.

There is one other specimen of this variety, probably a part of the same colony. It shows no additional characters of value except that reproduction may be by lateral gemmation.

The following are the species of West Indian Astrangids:

Phyllangia americana Milne-Edwards & Haime (= *Stellangia reptans* Duch. & Mich. = *Astrangia phyllangoides* Duch. & Mich.).

Astrangia solitaria (Le Sueur) (= *Astrangia neglecta* Duch. & Mich. = *Astrangia granulata* Duch. & Mich.).

Astrangia astreiformis Milne-Edwards & Haime (? = *Astrangia michelini* Milne-Edwards & Haime). *Astrangia danæ* L. Agassiz, from the northeastern coast of the United States is very close to this species, but there are, in my opinion, sufficient differences to keep the two distinct.

There are three astrangids found on the Brazilian reefs. One is *Phyllangia americana*; another may be only a varietal form of *A. solitaria*, but probably is a distinct species; the third is an undescribed species, which I have named in manuscript, *Astrangia rathbuni*.

The Tertiary species might be added to this list: *Phyllangia floridana* Gane. Pliocene, of Caloosahatchie, Florida; *Astrangia lineata* (Conrad) and (*Cœnangia*) *bella* (Conrad), Chesapeake Miocene, of the Southern Atlantic slope of the United States.

The *Astrangia* (*Cœnangia*) *marylandica* (Conrad), of Verrill and Gane, is, as, Gane has intimated, the young of *Septastrea sexradiata* (Lonsdale).

Astrangia expansa Vaughan. Jacksonian, Eocene. *A. ludoviciana* Vaughan, Jacksonian, Eocene. *A. harrisi* Vaughan. Jacksonian. Eocene. *A. wilcoxensis* Vaughan, Midwayan, Eocene.

The three species with which comparison should be made are *Phyllangia floridana* Gane, *Astrangia lineata* (Conrad) and *Astrangia solitaria* (Le Sueur). The corallites of *Phyllangia floridana* are not so tall, possess wider bases, the costæ are more prominent, and the margins of the septa of the first cycle are not so exsert. The pali and columella are the same in both, and the septal dentations seem to be of the same character. The margins of the septa of the first and second cycles are entire in *Ph. floridana*. All of the septa of *Astrangia lineata* possess well-developed truncated dentations, and there are no differentiated pali. As already stated, this apparently should be regarded as a variety of *A. solitaria* (Le Sueur).

Pourtalès[1] says of *A. solitaria*, "All the septa are coarsely and bluntly denticulated." All of the septa may be denticulate, or the margins of the first cycle may be entire or faintly crenate. The actual difference of var. *portoricensis* consists in the larger size of the corallites and their more distinctly turbinate shape.

I have three fine colonies of *A. solitaria* for comparison, one from Honduras (W. A. Stanton, collector), property of the U. S. National Museum, and two loaned me by Dr. J. E. Duerden and collected by him in Jamaica. The size of the adult corallites is quite constant; the variation in diameter in the Honduran specimen being between 4 and 5 mm. The tallest corallite in the Honduran specimen is about 8 mm. The usual height is between 5 and 6 mm. Duchassaing & Michelotti's figure of *A. neglecta*, (op. sup. cit.), pl. x, figs. 3, gives a good idea of the general appearance of the species. The characters of the septal margins have been noted. The septa of the third and fourth cycles are finely dentate; those of the first and second cycles are usually bluntly or crenately dentate. Occasionally the crenations may be faint, and very rarely a septum appears to possess an entire margin.

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[1] Ill. Cat. Mus. Comp. Zool., No. IV, p. 79.

Astrangia astreiformis Milne-Edwards & Haime, var. Pl. II, figs. 2, 2*a*, 2*b*.

1850. *Astrangia astreiformis*, Milne-Edwards & Haime. Ann. Sci. Nat., 3ième sér., Zool., t. XII, p. 181.
1857. *Astrangia astræiformis*, Milne-Edwards & Haime. Hist. Nat. Corall., t. II, p. 614.

There is one specimen in the collection referred to this species. It is not typical, the corallites are not soldered one to another to their summits, but many corallites are free from very near their bases. There are distinct, usually equal, costæ on the outer free part of the corallites. There is a fairly good suite of specimens of *A. astreiformis* in the United States National Museum, and a careful comparison has been made with them. There is much variation within a single corallum in the approximation of the corallites, and very often, or usually, the outside of the free portion of a corallite is distinctly costate. As the septa and columella are the same as in typical *astreiformis* and the specimen from Porto Rico, and as the other features are so variable, I have considered them specifically identical.

The *Astrangia michelini* has given me much trouble. The figure given by Milne-Edwards & Haime[1] suggests great similarity to this specimen from Porto Rico. I have not seen the type and do not know where it is from.

From station 6090, off Culebra, Culebritas light-house. Bathymetric occurrence, 16 fathoms.

Family ORBICELLIDÆ, nom. nov.

Type genus, *Orbicella* Dana.

Salient family characters: Calcareous tissues normally imperforate, except in the columellar region. Corallites grouped into rounded, gibbous, or digitiform masses. Septal margins dentate. Reproduction normally by gemmation between the corallites, occasional abnormal reproduction by fission.

I have shown in my Eocene and Lower Oligocene Coral Faunas of the United States[2] that the name *Astrea* can not be used in coral nomenclature; that the name was first applied to a mollusk; also, if the name were used for a genus of corals, that it would have to supplant *Siderastrea*. I have therefore dropped the family name *Astræidæ* altogether. The old Astreid corals of those found in Porto Rico are distributed in four families, viz: *Eusmilidæ* Verrill, *Astrangidæ* Verrill, *Orbicellidæ* nom. nov., and *Favidæ* Gregory. The reasons for proposing the latter new name will appear later.

Genus ORBICELLA Dana, 1846.

1846. *Orbicella*, Dana, Zooph. Wilkes Expl. Exped., p. 205.
1857. *Heliastræa*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 456.

Attention has several times been called to the fact that Dana understood by *Orbicella* what Milne-Edwards & Haime meant by their later described *Heliastræa*.[3]

The characterization given by Dana is "Cells nearly circular, more or less prominent, not subdividing, or rarely so; stars with distinct limits formed by the coalescence laterally of the lamellæ, and therefore cells appearing tubular and separated by interstices." From his characterization and subsequent treatment of the species, it is evident that *Orbicella radiata* or *annularis* is regarded as typical. Dana confused some other genera with *Orbicella*, similar to the confusion by Milne-Edwards & Haime of other genera with *Heliastræa;* the meaning of the respective authors, however, is clear, and Dana's name, because of priority, must replace that of Milne-Edwards & Haime.

I have seen in the literature on corals no reference to the genus *Favites* Link.[4] He defined the genus "Unförmige, kalkartige Massen, mit oberflächlichen zerstreuten sternförmigen blättrigen Oeffnungen"; and included in it " *F. astrinus*, *Madrepora favites*, Linn. Gmel. Syst. Nat., p. 3763, Esper's Pflanzenth. Fortsetz. 1, Madr., t. 44–46—*F. cavernosus*, Linn. Gmel. Syst. Nat., p. 3767, Esp. Fortsetz. 1, Madr., t. 37—and *F. pentagonus*, Esp. Fortsetz. 1, Madr., t. 39." Link's *Favites astrinus* includes a species of *Favia* (Esper, t. XLIV) and species of *Prionastrea*. *Favites cavernosus* is *Orbicella cavernosa*. *Favites pentagonus* is a *Goniastrea*. Four genera are included in *Favites*. The name *Favia* was first given by Oken to a species not included in Link's list, but it applies to *Madrepora favosa* of Esper (pl. XLIV); *Orbicella* Dana takes in *F. cavernosa*. *Fissicella* Dana, 1846, contains a conglomeration of forms, *Favia*, *Dichocœnia*, *Prionastrea*, etc. The name in my opinion should be discarded, as it is a sort of renaming of Oken's *Favia*. Milne-Edwards & Haime, 1848,[1] proposed *Goniastrea*, which equals a part of Link's *Favites*, and proposed at the same time *Prionastrea*, which takes in the residue of *Favites*. *Favites* should be used instead of *Goniastrea* or *Prionastrea*. Since the greater portion of *Madrepora favosa* of Esper is *Prionastrea*, as this is the first name in the list of Link's species, and as *Prionastrea* occurs after the characterization of *Goniastrea*, in my judgment *Favites* should supplant *Prionastrea*.

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[1] Ann. Sci. Nat., 3ième sér., Zool., t. X, pl. VII, fig. 5.

[2] Mon. U. S. Geol. Surv., No. XXXIX, pp. 154–155.

[3] Pourtalès, Ill. Cat. Comp. Zool., No. IV, 1871, p. 76. Verrill, in Dana's Corals and Coral Islands, 1872, p. 388. Quelch, Reef Corals, Challenger Exp., 1886, p. 106. Gregory, Jour. Geol. Soc. Lond., vol. LI, 1895, p. 270.

[4] Beschreibung der Naturalien-Sammlung der Universität zu Rostock, 3te Abth., Rostock, 1807, p. 162.

Tubastrée de Blainville[2] was not given a Latin form by him, and was not used Latinized by him in any combination, so it does not have to be considered in a discussion of synonymy.

Orbicella acropora (Linn.), var. Pls. VI and VII.

1766. *Madrepora acropora*, Linnæus, Syst. Nat., ed. XII, p. 1276.
1786. *Madrepora annularis*, Ellis & Solander, Nat. Hist. Zooph., p. 169, pl. LIII, figs. 1, 2.
1786. *Madrepora faveolata*, Ellis & Solander, op. cit., p. 166, pl. LIII, figs. 5, 6.
1797. *Madrepora acropora*, Esper, Fortsetz. Pflanzenth., I, p. 21, tab. XXXVIII, figs. 1, 2.
1846. *Astrea* (*Orbicella*) *annularis*, Dana, Zooph. Wilkes Expl. Exped., p. 214, pl. X, fig. 6.
1857. *Heliastræa annularis*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 473.
1857. *Heliastræa acropora*, Milne-Edwards & Haime, op. sup. cit., p. 477.
1861. *Heliastræa lamarcki*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 76 (of reprint). Determined by examination of the specimens of Duchassaing & Michelotti in Turin; probably not *Heliastræa lamarckana* Milne-Edwards & Haime.
1863. *Phyllocœnia sculpta*, Duncan, Quart. Journ. Geol. Soc. London, vol. XIX, p. 432.
1863. *Phyllocœnia limbata*, Duncan, op. sup. cit., p. 433.
1863. *Cyphastræa costata*, Duncan (the type from Barbuda), op. jam cit., p. 443.
1863. *Astræa barbadensis*, Duncan, op. jam cit., pp. 421 and 444, pl. XV, figs. 6*a*, 6*b*.
1864. *Plesiastræa ramea*, Duncan, Quart. Jour. Geol. Soc. London, vol. XX, p. 39.
1880. *Orbicella annularis*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, No. 1, pl. IV, all figs.
1890. *Orbicella annularis*, A. Agassiz, Bull. Mus. Comp. Zool., vol. XX, No. 2, p. 61, pls. I, II.
1895. *Orbicella acropora*, Gregory, Quart. Journ. Geol. Soc. London, vol. LI, p. 272.
1895. *Cyphastræa costata*, Gregory, op. sup. cit., p. 274.
1895. *Echinopora franksi*, Gregory, op. jam cit., p. 274, pl. XI, figs. 2*a*, 2*b*, 2*c*, and 3.

Gregory has published notes on the synonymy of this species.[3] He bases his placing of *annularis* under the synonymy of *acropora* upon finding in some calices no septa corresponding to the last cycle of costæ, while in other systems or in portions of other systems the septa of the last cycle may be well developed, i. e., he destroys the specific distinction established by Milne-Edwards & Haime. The figure of the enlarged corallites given by Esper (pl. XXXVIII) shows three complete cycles of septa and costæ, and from his description and figure there can be no doubt about his having had the common small-celled *Orbicella* of the West Indies, and that it is the same as the *Madrepora annularis* of Ellis & Solander.

H. Stanley Gardiner[4] identified a coral from Rotuma Island in the South Pacific as *Orbicella acropora* (Linnæus); he adds some notes, and calls attention to Esper's (Fortsetzungen) pl. XXXVIII, fig. 2. I have not seen Gardiner's specimens and do not know how closely they resemble those from the West Indies, but we do know that Esper's specimens came from the West Indies. He says concerning his specimens[5] "Sie kommen von den südlichen amerikanischen Meeren." We can be sure that what is here called *Orbicella acropora* is what Esper called *Madrepora acropora*, and I suspect that Gardiner's *Orbicella acropora* is a different species.

The remainder of the synonymy is extremely perplexing because of the insufficient description of the species, lack of figures, or that the types are lost or confused.

Cyphastræa oblita Duchassaing & Michelotti. The specimen so labeled in Turin is a rounded-head possessing the general aspect of *Orbicella acropora*; the calices are small, usually 2 mm. in diameter; the septa are in three complete cycles, the third cycle being very small; the costæ are as in *Orbicella acropora*. A specimen labeled *Cyphastræa oblita* in the Muséum d'Histoire Naturelle at Paris is an entirely different thing. It belongs to the genus *Solenastrea* and is the same as the *Heliastræa*

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[1] Comptes Rendus Acad. Sci., t. XXVII, p. 495.
[2] Man. Actin., 1834, p. 368.
[3] Quart. Jour. Geol. Soc. Lond., vol. LI, 1895, p. 272.
[4] Proceed. Zool. Soc. Lond. for 1899, pt. III, p. 752.
[5] Op. cit., p. 23.

abdita D. & M., which is not a synonym of *Orbicella acropora*, as Gregory states in his synonymy of the species.

Cyphastræa costata Duncan. The type from Barbuda preserved in the collection of the Geological Society of London is a specimen of *Orbicella acropora*. Some of the septa are cribriform almost to the corallite wall, while others extend as solid lamellæ far into the corallite cavity joining the columella by septal processes; in fact, the columella is made up of these processes. The corallite walls are dense, and are united among themselves by costæ which are stout and correspond to all cycles of septa; diameter of corallites 3 to 4 mm., usually about 3.5. Exotheca well developed; the dissepiments extend straight across the intercostal spaces; two dissepiments to 1.5 mm. Distance between corallites 1 to 2 mm., usually only about 1 mm. Almost any corallite of *Orbicella acropora* will show the septal peculiarities of Duncan's *Cyphastræa costata*, so Duncan's species is the exact equivalent of the former. A specimen, also in the Geological Society of London, from Santo Domingo, seems to be a *Solenastrea;* the corallites are joined by a vesicular exotheca and differ in other ways from Duncan's type. The specimens identified by Gregory from Barbados as *Cyphastræa costata* are *Orbicella acropora*. The material studied by him is in the British Museum.

Orbicella hyades is, according to Pourtalès,[1] probably a *Solenastrea*. The *Solenastrea hyades* of Duchassaing is a *Solenastrea*, as an examination of the specimens in Turin Museum showed, and is not a synonym of *Orbicella acropora*, as Gregory makes it. I was unable to find the type of *Heliastræa rotulosa* in Turin, and as the work of Duchassaing & Michelotti is throughout so poor, the species can not be determined, so should be discarded altogether. Gregory places it in the synonymy of *Orb. acropora*, and so much as one can make out of the original description supports his reference.

Some of the specimens of this species instead of being rounded heads, or more or less explanate, are small columns. One specimen from the elevated reefs of Curaçao (K. Martin collection) is about 90 mm. long and possesses a maximum diameter of 25 mm. Except in form, there is nothing abnormal. *Plesiastræa ramea* Duncan, from Santo Domingo, is absolutely the same as this growth form of *Orbicella acropora*. I have examined the type in the collection of the Geological Society of London, and the officers of the society have kindly sent a duplicate to the U. S. National Museum. *Phyllocœnia limbata* Duncan is the same as the *Plesiastræa ramea* (type, coll. Geol. Soc. Lond.). *Phyllocœnia sculpta* Duncan (non Michelin) var. *tegula* Duncan, also from Santo Domingo, is an explanate form of *Orbicella acropora*. Except in form, it possesses no distinguishing characteristics, size of corallites, septa, costæ, columella, exotheca, and endotheca as commonly in *O. acropora*. (Type, coll. Geol. Soc. Lond.; duplicate in U. S. National Museum.) Gregory's *Echinopora franksi* from Barbados is only a specimen of the same species. At first I thought it could be separated from *O. acropora* by its having solid walls, without exotheca between the corallites, but an examination of the splendid suite of recent specimens in the U. S. National Museum showed this to be only an individual variation. There is no character by which it can be separated from *O. acropora*. (Type in British Museum; duplicate in U. S. National Museum.)

There are three specimens of this species in the collection from Porto Rico; the largest is a head about 33 cm. high and 27 cm. in diameter. The calices are larger than is usual in the species, usually 4 to 4.5 mm. in diameter, and the septa are thinner than usual. The members of the first and second cycles have very exsert margins.

From Mayaguez.

Family FAVIDÆ Gregory.

Type genus, *Favia* Oken.

Salient family features the same as in the *Orbicellidæ*, except that reproduction is by *fission* or *septal* budding.

A large number of genera belong here, e. g., *Goniastrea*, *Prionastrea* (=*Favites* Link, pro parte), *Platygyra*, *Leptoria*, *Stiboria*, *Manicina*, etc.

Verrill's *Mæandrinidæ*,[2] in my opinion, is equal to *Favidæ*. It has been shown in this paper that the original *Meandrina* of Lamarck is not the *Mæandrina* of Milne-Edwards & Haime, Verrill, Duncan, and others; therefore the family name must be changed.

The group of genera represented by *Lithophyllia* (=*Scolymia* Haime, the older name), *Isophyllia*, *Mussa*, etc., probably should be grouped in another, but closely related, family, or in a subfamily.

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[1] Mus. Comp. Zool., Ill. Cat. No. IV, 1871, p. 77.

[2] Proc. Essex Inst., vol. IV, No. IX, 1865, p. 147.

Genus FAVIA Oken. 1815.

Favia fragum (Esper). Pl. VIII.

1766. *Madrepora ananas*, Pallas, Elench. Zooph., p. 321 (non-Linnæus, Syst. Nat., ed. x, 1758, p. 797).
1767. *Madrepora ananas* (pars), Linnæus, Syst. Nat., ed. XII, t. I, p. 1275.
1797. *Madrepora fragum*, Esper, Pflanzenth., Fortsetz., Th. I, p. 79, pl. LXIV, figs. 1 and 2. (Non *Madrepora ananas*, Esper, Pflanzenth., pp. 126–131, pl. XIX.)
1815. *Favia ananas* (pars), Oken, Lehrb. Naturgesch., Bd. I, p. 67.
1816. *Astrea ananas*, Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 260.
1834. *Favia uva* (pars), Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss., Berlin for 1832, p. 369.
1847. *Parastrea ananas*, Milne-Edwards & Haime, Comptes Rendus, t. XXVIII, p. 495.
1850. *Parastrea fragum*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ième sér., Zool., t. XII, p. 175.
1861. *Favia incerta*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 75 (of reprint), pl. X, figs. 13, 14.
1861. *Favia coarctata*, Duchassaing & Michelotti, op. sup. cit., p. 76, pl. X, figs. 17, 18.
1871. *Favia ananas*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 75.
1895. *Favia ananas*, Gregory, Quart. Jour. Geol. Soc. Lond., vol. LI, p. 260.

This species has usually been known by the name *Favia ananas*, the specific name being referred back to Pallas's Elenchus Zoophytorum. The name *Madrepora ananas* was not available for this species, as Linnæus had already applied it to a palæozoic coral from Gothland, now known as *Acervularia ananas*. Professor Lindström has discussed the name as applied to the fossil species in his "On the Corallia Baltica of Linnæus."[1] After Pallas there followed great confusion, the Baltic fossil and the West Indian recent species bearing the same name, and evidently considered by authors to be the same thing. In the meantime Esper proposed the name *Madrepora fragum* for the West Indian species. Therefore the *ananas* of Linnæus must be restricted to the fossil species, and the *ananas* of Pallas must give way to *fragum* of Esper. The confusion of *ananas* is still greater for Esper, although he renamed Pallas's *ananas*, applied the same name to a species of *Dichocœnia* from the East Indies, now known as *Dichocœnia porcata*. The *Explanaria ananas* of Ehrenberg is, as shown by an examination of his material in the Museum für Naturkunde at Berlin, *Dichocœnia stokesi*.

Esper's figures and the description of *fragum* are very good, and answer perfectly to the ordinary West Indian *Favia*. A note which accompanies the figures in the Museum of Comparative Zoology's copy, and which presumably was made by Pourtalès, states, "This seems to be what we have labeled *F. ananas* throughout the collections."

I was able to examine the types of Duchassaing & Michelotti's *Favia incerta* and *Favia coarctata* in Turin. The difference between the three may be tabulated thus:

Favia incerta D. & M.	Wall between corallites not thick; calicular margin not elevated.
Favia coarctata D. & M.	Wall between corallites not thick; calicular margin elevated.
Favia ananas Lamarck	Wall between corallites thick; calicular margin elevated.

The first species is founded on a somewhat worn specimen. Another worn specimen, grouping with *incerta*, is labeled *Favia fragum*. The series of six specimens possessed by Duchassaing & Michelotti, had they studied them carefully, should have shown them that they were dealing with variations of a single species, to which they attached four different names.

There is in the U. S. National Museum a suite of over 80 recent specimens from various localities in the West Indian region. Notes on the variations of these specimens may be of interest in connection with the synonymy given above. First, there are 17 specimens from the island of Curaçao, collected by the *Albatross* expedition in 1888. The specimens are all small encrusting, usually capuliform or subhemispherical masses. The greatest distance across a colony rarely exceeds 45 mm. The calices are subelliptical or are deformed; in only one instance did I find indications of two calicinal centers in a series, except where fission is in progress. Reproduction is by septal budding—fission. The calices are divided into subequal halves. The calices are not very long; 6.5 mm. in length by 4.5 in breadth is large for one in which there is no evidence of the beginning of division. There are calices, almost circular, only 3 mm. in diameter. The thickness of the walls between corallites varies very much, from merely a separating rim to 2 mm., or even more. The elevation of the calicular margin also shows great variation. It may not be noticeably elevated, or it may form the rim of a truncated deformed cone, standing a millimeter, or even slightly more, above the depression between adjoining corallites. The septa vary between three complete cycles and very nearly four complete cycles; common numbers are from thirty-six to a few over forty. The septal cycles are not distinctly marked, but the members of the first and some of the second are usually larger than the others. The youngest septa are much smaller than the bounding older ones. The amount of exsertness and the thickness of the septa are variable, but the septa could scarcely ever be characterized as very thin, although they sometimes are quite thin. The septal margins are irregularly and rather jaggedly dentate, and bear near the columella an irregular, jagged, paliform tooth. Costæ correspond to all septa and show a variation in size corresponding to that of the septa; they are rather acute, not very or only fairly prominent, and have their margins pointedly dentate, the dentations on the costæ being more regular than those on the septa. The columella is rather large, very spongy, and usually forms a flattish bottom to the fairly deep calice.

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[1] Öfvers. K. Svensk. Vet. Akad., Förhandl., Arg. LII, 1895, pp. 628, 629.

From east of Fort Taylor, Key West (Dr. Edward Palmer, collector), is a lot of 32 specimens. These in general differ from the Curaçaoan specimens by having thinner walls between the corallites, 1.5 mm. being about the average thickness; in some specimens the adjoining calices are separated by merely a rim, by having the calicular margins not or scarcely perceptibly elevated, and by having very often narrow corallites with a tendency to become sinuous. One specimen possesses a calice 6 mm. long and less than 2 mm. wide. The intergradation between these specimens and those from Curaçao is seen to be perfect when some specimens from Key West (collected by Hemphill) and Tortugas (collected by Palmer) are placed between them. There is no need to cite more specimens, except one from St. Thomas (collected by the *Albatross* expedition). This specimen would be referred to *Favia incerta* D. & M. It is an irregularly capuliform mass with a greater diameter of 50 mm., a lesser of 46, and a height of 38. It has the general appearance of the ordinary *F. fragum*, except that over the whole upper surface of the colony the walls are thin and simple. Instances of simple walls have been cited before, but in no case did such occur over the whole upper surface of the specimen. Around the edges the specimen from St. Thomas has assumed the form of wall usually found in *F. fragum*, so that if one had a piece broken from the edge, especially at one particular end, he would immediately pronounce it *F. fragum*.

From the above discussion one might think this species has no criterional characters; but it has, and they are quite definite. They are: (1) The size and shape of the colony; (2) the size and shape of the calices; (3) the number of the septa; (4) the septal dentations, the pali, and the character of the columella. This gives a number of characters, and throws over only the basis on which Duchassaing & Michelotti attempted to differentiate the species.

Verrill has described 3 species of *Favia* from Hartt's Brazilian collections.[1] They are *Favia leptophylla*, *Favia gravida*, and *Favia conferta*, all three from the Abrolhos Reefs. We have in the U. S. National Museum, from Brazil, 29 specimens of this group of *Favia*, and upon them and Verrill's original description I base the following remarks. The features by which the species would be separated among themselves are:

F. leptophylla......	Septa 24 to 30, calices circular or deformed, about 0.25 inch in diameter.
F. gravida.........	Margins elevated the same as *F. leptophylla*, except that there are four complete cycles of septa.
F. conferta	Possesses narrow, long meandriform calices, usually series, with several calicinal centers.

There are no specimens of *F. leptophylla* in the U. S. National Museum. The other two species, in my mind, grade into each other, showing a variation in prominence of calicular margins and thickness of wall between adjoining corallites similar to what has been described for *F. fragum*. The essential specific characters are (1) the number of septa, usually at least four complete cycles—i. e., they are more numerous than in *F. fragum*; (2) the calices are nearly always larger, or at least longer, than in *fragum*, and may be so long and sinuous that they are meandriform; when the calicular margins are free and elevated, they rise perpendicularly from the common surface of the corallum; (3) the septal dentations seem very much more regular than in *F. fragum*. There are points of resemblance between *fragum* and the Brazilian species, but the two seem to me very distinct. I would suggest that of Verrill's two names, *gravida* and *conferta*, applied to the Brazilian species, *conferta* be suppressed and *gravida* be used as the specific designation.

As I have seen no specimens of *F. leptophylla*, I can express no opinion upon it.

The three specimens of *Favia fragum* in the Porto Rican collection present no special characters worthy of note. The size of one is, greater diameter, 26 mm.; lesser, 24 mm.; height, 18 mm. Two specimens, preserved in alcohol, came from the Playa de Ponce.

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[1] Trans. Conn. Acad. Sci., vol. I, 1868, pp. 353, 355.

Genus MANICINA Ehrenberg. 1834.

Manicina areolata (Linn.). Pl. IV, figs. 2 and 3.

1758. *Madrepora areolata*, Linnæus, Syst. Nat., ed. X, p. 795.
1789. *Madrepora mæandrites* (pars), Esper, Pflanzenth., p. 76 (bis = 81)-84, pl. IV, non IV A.
1815. *Mæandra areola*, Oken, Lehrb. Naturgesch., Bd. I, p. 70.
1816. *Mæandrina areolata*, Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 247.
1834. *Manicina hispida*, Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 327.
1834. *Manicina prærupta*, Ehrenberg, op. sup. cit., p. 327.
1834. *Manicina manica*, Ehrenberg, op. sup. cit., p. 327. Non *Manicina areolata* Ehrenberg = *Trachyphyllia geoffroyi* (Audouin), *fide* Milne-Edwards & Haime.
1849. *Manicina valenciennesi*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ieme sér., Zool., t. XI, p. 287.
1861. *Manicina crispata*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 74 (of reprint), species of Milne-Edwards & Haime.
1861. *Manicina danai*, Duchassaing & Michelotti, op. sup. cit., p. 74, species of Milne-Edwards & Haime.
1871. *Manicina areolata*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 72.
1880. *Manicina areolata*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, No. 1, pl. V, figs. 1-22 (all figs.), and pl. VI, figs. 1-7 (all figs.).
1888. *Manicina areolata*, Wilson, Jour. Morph., vol. II, No. 2, pp. 191-252, pls. I-VII.
1895. *Manicina areolata*, Gregory, Quart. Jour. Geol. Soc. Lond., vol. LI, pp. 264-265.
1895. *Manicina pliocenica*, Gane, Johns Hopkins Univ. Circ., vol. XV, No. 121, p. 10.
1900. *Manicina pliocenica*, Gane, Proc. U. S. Nat. Mus., vol. XXII, pp. 192, 193.
1900. *Manicina areolata*, Vaughan, Mon. U. S. Geol. Surv., No. XXXIX, pp. 38-40, pl. I, figs. 2, 3.

The types of Ehrenberg's species were studied in the Museum für Naturkunde, in Berlin, and the specimens of Duchassaing & Michelotti were studied in Turin. Gane's *Manicina pliocenica* is placed in the synonymy of *M. areolata*, as a result of comparison of his type material with recent specimens in the U. S. National Museum.

From Ensenada Honda, Mayaguez, and Aguadilla, a single specimen from each place. Those from Mayaguez and Aguadilla are small and beach-worn. The one from Ensenada Honda is good, and was preserved in alcohol. Station 6079, off St. Thomas, Sail Rock, in 20 to 23 fathoms.

Genus PLATYGYRA Ehrenberg, 1834.

1815. *Mæandra* (pars), Oken, Lehrb. Naturgesch., pp. 68 and 70.
1816. *Meandrina* (pars), Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 244.
1834. *Mæandra* (pars) (+ subgenus *Platygyra* (pars)) Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 323.
1846. *Meandrina* (pars), Dana, Zooph. Wilkes Expl. Exped., p. 252.
1848. *Meandrina* + *Cœloria*, Milne-Edwards & Haime, Comptes Rendus, t. XXVII, p. 493.
1857. *Mæandrina*, Milne-Edwards & Haime, Hist. Nat. Corall., t. II, p. 388 + *Cœloria*, ibid, p. 411.
1884. *Mæandrina*, Duncan, Jour. Linn. Soc. Lond., vol. XVIII, p. 88.

The names *Meandrina* and *Mæandra* have been disposed of. The name *Platygyra* Ehrenberg remains to be considered. Ehrenberg placed the following species in the subgenus (as recognized by him), viz: *labyrinthica*, including the varieties *α leptochila* and *β pachychila; lamellina*, sp. nov.; *cerebriformis* Lamarck, including the varieties *α* and *β; phrygia* Lamarck; *spatiosa*, sp. nov. I made a careful study of most of the original specimens referred to these species by Ehrenberg.

There are six specimens in the Museum für Naturkunde, in Berlin, bearing the name *Mæandra* (*Platygyra*) *labyrinthica*, but there appear to be four distinct species.

1. Specimens Nos. 682, 683, and 687 are *Cœloria labyrinthiformis* of Milne-Edwards & Haime.[1]

2. Specimen No. 668, var. *pachychila* Ehr. = *Cœloria forskælana* Milne-Edwards & Haime.[2]

3. Specimen No. 669. No locality is given. "*M. filograna* Esp." is written on the label below the name given by Ehrenberg. The corallum is a head deformed by certain parts dying; it is about 160 mm. high. The valleys are very long and sinuous, frequently forming sharp angles in the sinuosities. Wall between the series thin and acute at top, thickening below. Depth of valleys 6.5 to 7 mm. Cross section of colline angular above. Septa, 12 to 15 cm., nearly all of equal size, only occasionally a small or rudimentary one between a pair of large ones; they do not project much above the wall between the valleys. The septal dentations are subequal, except that the lowest is often much larger than the others. The columella is formed of septal trabeculæ and lobes; it is very often of a loose, spongy texture. This is not *filograna* Esper, but is probably *viridis* Le Sueur (=*strigosa* Dana).

4. Specimen No. 671, bears "*M. grandilobata* M. E." on the label below Ehrenberg's name. This is correct, only it must now be called *clivosa* of Ellis & Solander.

I did not study *M. Platygyra lamellina*.

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[1] Hist. Nat. Corall., t. II, p. 413.

[2] Hist. Nat. Corall., t. II, p. 414.

M. Platygyra cerebriformis=*Diploria cerebriformis* (Lam.), which must be called *Diploria labyrinthiformis* (Linn).[1]

M. Platygyra phrygia = *Leptoria phrygia*, *fide* Milne-Edwards & Haime.

M. Platygyra spatiosa = a synonym of *Dendrogyra cylindrus*. It is the basal portion of a large column.

Ehrenberg had in his *Platygyra* 8 species now distributed among 5 genera: *Mæandrina*, 2 species (not *Meandrina* Lamarck 1801); *Cæloria*, 3 species; *Diplora*, 1 species; *Leptoria*, 1 species; *Dendrogyra*, 1 species. The name *Meandrina* can not be applied to any of these forms. The order of the publication of these genera, except *Meandrina*, is:

Dendrogyra Ehrenberg, 1834.
Diploria Milne-Edwards & Haime 1848.[2]
Leptoria Milne-Edwards & Haime 1848.
Cæloria Milne-Edwards & Haime 1848.
} Arranged according to sequence on the page.

Ehrenberg in his treatment of *Platygyra labyrinthica* makes no mention of the West Indian forms, discussing only those from the Red Sea; therefore if we follow his published work, the former must be omitted. The name *Platygyra* must be used instead of one of the four genera above noted. Since *Cæloria* comes last among those proposed by Milne-Edwards & Haime, I substitute *Platygyra* for *Cæloria*, following Dr. Brüggemann, who, in his "Corals of Rodriguez,"[3] shows that *Platygyra* should take the place of *Cæloria*, and remarks that the type species is the *Madrepora labyrinthica* from the Red Sea. His course, in my opinion, is the only logical one.

Pourtalès[4] was the first of whom I know to point out the difficulty or impossibility of separating *Cæloria* and *Mæandrina* (Milne-Edwards & Haime). Duncan places *Cæloria* as a subgenus of *Mæandrina*.[5] H. Stanley Gardiner has made some notes on the relations of the genera.[6] I can find no tangible differences between the two, the columellar characters being insufficient, therefore I merge *Cæloria* and *Mæandrina* of Milne-Edwards & Haime into a single genus and call it *Platygyra* Ehrenberg. If the West Indian species can not be referred to *Platygyra*, they must receive a new generic designation.

Platygyra viridis (Le Sueur). Pls. IX, X, XI, XII, XIII.

1786. *Madrepora labyrinthica*, Ellis & Solander, Nat. Hist. Zooph., p. 160, pl. XLVI, figs. 3, 4. Non *Madrepora labyrinthica*, Pallas, 1766.
1797. *Madrepora mæandrites*, var., Esper, Pflanzenth. Fortsetz., Th. I, p. 101, pl. LXXXVII (*fide* Milne-Edwards & Haime).
1820. *Meandrina sinuosa?* Le Sueur, Mém. Mus. Hist. Nat. Paris, t. VI, p. 278, pl. XV, fig. 4; + vars. *viridis*, p. 279, pl. XV, fig. 5; *appressa*, p. 280, pl. XV, fig. 6; *rubra*, p. 280, pl. XV, fig. 7; *vineola*, p. 280, pl. XV, fig. 8. Non *Madrepora sinuosa*, Ellis & Solander, 1786, nec *Meandrina sinuosa*, Quoy & Gaimard, 1833.
1820. *Meandrina dedalea*, Le Sueur, op. sup. cit., p. 281, pl. XVI, fig. 9.
1820. *Meandrina labyrinthica*, Le Sueur, op. sup. cit., p. 282, pl. XVI, fig. 10.
1834. *Mæandra* (*Platygyra*) *labyrinthica* (pars), Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 323.
1846. *Meandrina strigosa*, Dana, Zooph. Wilkes Expl. Exped., p. 257, pl. XIV, figs. 4*a*, 4*b*.
1849. *Meandrina heterogyra*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ième sér., Zool., t. XI, p. 281.
1849. *Meandrina sinuosissima*, Milne-Edwards & Haime, op. sup. cit., p. 281.
1849. *Meandrina serrata*, Milne-Edwards & Haime, op. sup. cit., p. 282.
1849. *Meandrina crassa*, Milne-Edwards & Haime, op. sup. cit., p. 282.
1861. ? *Leptoria hieroglyphica*, Duchassaing & Michelotti, Mém. Cor. Ant., p. 75 (of reprint).
1861. *Leptoria fragilis*, Duchassaing & Michelotti, op. sup. cit., p. 75.
1880. *Mæandrina strigosa*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, No. 1, pl. IX, figs. 6–9.
1880. *Mæandrina labyrinthiformis*, Pourtalès, op. sup. cit., pl. IX, figs. 10–12.
1886. *Mæandrina strigosa*, Quelch, Reef Corals, Challenger Exp., pp. 10, 92.
1886. *Mæandrina sinuosissima*, Quelch, op. sup. cit., pp. 10, 91.
1886. *Mæandrina labyrinthica*, Quelch, op. sup. cit., pp. 10, 12, 91.
1886. ?*Mæandrina sinuosa*, Quelch, op. sup. cit., p. 12.
1895. *Mæandrina filograna*, Gregory, Quart. Jour. Geol. Soc. London, vol. LI, p. 265. The synonymy includes two species, *Platygyra viridis* and *Platygyra clivosa* (Ell. & Sol.)
1898. *Mæandrina* + *filograna*, Vaughan, Bull. Mus. Comp. Zool., vol. XXVIII, No. 5, p. 275.
1901. *Meandrina labyrinthica* + *Ctenophyllia*, Whitfield, Bull. Amer. Mus. Nat. Hist., vol. XIV, pp. 221–222, pls. XXXI, XXXII.

In the preparation of the above synonymy the following collections have been studied: The Ehrenberg collection, in Berlin; the types and other specimens of Duchassaing & Michelotti, in Turin; the types of the four species of Milne-Edwards & Haime, in the Muséum d'Histoire Naturelle, Paris;

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[1] See paper on "Some fossil corals from the elevated reefs of Curaçao, Arube, and Bonaire, pp. 45–48.

[2] Comptes Rendus, t. XXVII, 1848, p. 493.

[3] Phil. Trans. Royal Soc., vol. CLXVIII, 1879, p. 171.

[4] Ill. Cat. Mus. Comp. Zool., No. IV, 1871, p. 73.

[5] Jour. Linn. Soc. Lond., vol. XVIII, 1884, p. 89.

[6] Proc. Zool. Soc. Lond., vol. for 1898, p. 740.

Quelch's and Gregory's original specimens, in the British Museum (Natural History); and the excellent collection of the United States National Museum, which possesses Dana's type of *Meandrina strigosa*.

The first available name for this species is *viridis* of Le Sueur. The name *labyrinthica* of Ellis & Solander can not be used, as Pallas had applied it to *Madrepora mæandrites* Linnæus. The *sinuosa* of Le Sueur is a misidentification of the *Madrepora sinuosa* of Ellis & Solander, so it can not be used. The next name is var. *viridis* of Le Sueur. The varietal name is here raised to specific rank.

There are over 20 specimens of the *Platygyra viridis* group in the U. S. National Museum. Before proceeding to a discussion of the specimens it would be best to examine Milne-Edwards & Haime's mode of classification of the species of the genus, and those of their species that come from the West Indies.

Their first section comprises forms with "Le polypier formant une masse fortement gibbeuse ou même lobée," which comprises *M. filograna* (Esper) and *M. grandilobata* M.-E. & H. (to which should be added *M. clivosa* of Ellis & Solander, sp.). The second division has "Le polypier formant une masse légèrement gibbeuse" (here is placed *M. superficialis*); the third "Le polypier formant une masse simplement convexe sans gibbosités," and contains *M. heterogyra*. *M. sinuosissima*, *M. serrata*, and *M. crassa*. *Mæandrina valida* and *M. mammosa* Dana are placed in the "*espèces douteuses*," and *Meandrina strigosa* Dana is referred to *Cœloria* as a doubtful species.

To tabulate the characters which separate *heterogyra*, *sinuosissima*, *serrata*, and *crassa:*

M. heterogyra	Corallum convex, oblong: 12 to 14 septa to cm., usually equal: width of valleys, 6 mm.; depth, 4 or 5.
M. sinuosissima	The points of difference given by Milne-Edwards & Haime are the subspheroidal form, the septa crowded and alternating in size, narrow above and enlarging in the interior of the valleys. Valleys nearly a centimeter wide.
M. serrata	Would be separated from preceding by having valleys 7 mm. wide and 5 mm. deep.
M. crassa	Form as in *heterogyra*, otherwise resembling *sinuosissima*, except that the columella is greatly developed and valleys are 7 mm. wide and 3 or 4 mm. deep.

Milne-Edwards & Haime have based their division of these forms into 4 species on the following characters: (1) The corallum being elongate or subspheroidal; (2) the septa being all of the same size or alternately larger and smaller; (3) the collines being rounded above or acute; (4) the width of the valleys ranging between 6 mm. and 1 cm. in width and 3 to 5 mm. in depth. Minor importance is laid on the septal dentations and the development of the columella. I came to the conclusion that we have to deal with a single species from an examination of the Duchassaing-Michelotti material in Turin, and again to the same conclusion from a study of the specimens of Milne-Edwards & Haime in Paris and the specimens in the British Museum. I shall now describe in detail a single specimen from Belize, Honduras (collected by A. E. Morlan).

The specimen is about 23.5 cm. long by 19 cm. wide on the flattish base, and approximately 10 cm. high; i. e., the form is oblong. On one end the valleys are extremely sinuous, while on the other they are usually parallel, running perpendicular to the axis of elongation of the colony, and show very few sinuosities. The width of the valleys varies from 4.5 mm. to 9 mm.; i. e., in width of valleys this specimen takes in all species. The depth of the valleys varies from 2 mm. to 6 mm.; this specimen shows depths of valleys both lesser and greater than the extremes recorded by Milne-Edwards & Haime in their characterization of the species. The walls between the valleys are solid, but may vary somewhat in thickness. The septa probably present the greatest variation of any element of the corallum. For long distances there may be only large septa, with no hint of smaller septa between them, whereas on other portions of the surface the alternation of larger and smaller is perfectly regular. A place where there are only larger septa shows twelve to the centimeter on one side of the colline and thirteen on the other. In another place, where there is fairly regular alternation of larger and smaller, there are fourteen larger and thirteen smaller to the centimeter. These measurements cover all the four so-called species. The septa may be narrow at the top, sloping downward into the bottom of the valley, thus giving the colline a triangular profile, or they may arch gently over the top of the colline and have their inner margins fall perpendicularly to the top of the paliform lobe at the base. The paliform lobes may be entirely suppressed or they may be greatly developed, but whenever the inner margins of the septa fall perpendicularly to the bottom of the valley the paliform lobes are well developed. The septal dentations are usually quite regular, and are like the teeth of a saw ("en scie"), but there may occasionally be slight irregularities. The columella varies much. It may consist of weak, spongy calicinal centers, each pair connected by a septum, representative of a lamellar columella, or a spongy columella may be very considerably developed. Endotheca is well developed and quite vesicular; the dissepiments are thin.

It is evident that this one specimen, except in the matter of form, comprises all of the four above-discussed species. Whether a coral head is spheroidally rounded above or somewhat elongated in one direction is so much a matter of pure chance, depending upon the object to which it is attached, etc., that no one would think of separating species on that basis.

It seems to me that *Mæandrina superficialis* of Milne-Edwards & Haime, judging from the specimen I saw in Paris, may belong here, but according to their description it is a synonym of *M. clivosa*. To what species it should be referred depends upon whether the surface of the corallum is thrown into lobes. In my notes on the Paris specimens I have placed it in the synonymy of *Mæandrina strigosa*, and have added "septa to cm. 19, all of the same size; width of valleys, 4 to 6 mm., depth only about 2 mm.; columella, lamellar, interrupted, surrounded by very little vesicular tissue." However, *superficialis* may belong under *clivosa* of Ellis & Solander.

The *Leptoria fragilis* of Duchassaing & Michelotti is the same as *Mæandrina heterogyra*, and falls into the synonymy of *P. viridis*. I am not positive as to what should be done with their *Leptoria hieroglyphica*, but probably it also should be placed in the synonymy of *viridis*.

The *Mæandrina labyrinthiformis* and *Mæandrina strigosa* figured by Pourtalès in the Florida Reefs Corals[1] are the same species. The *labyrinthiformis* has lower collines and the septa are more broadly rounded over the summits of the collines, while in *strigosa* the septa have a tendency to be almost angular where they cross the wall. The paliform lobes are represented as being fully developed in *strigosa*. The amount of variation of each of these features in a single corallum has already been pointed out.

A few notes on the variation of some other specimens should be added. There is a specimen, the *labyrinthiformis* type, from Eastern Dry Rocks, Florida (collected by Palmer), that I thought could be kept separate from the other specimens, because the septal dentations are not saw-toothed ("en scie"), but often are rather long spines, or they may even be forked. We possess from Bermuda a single specimen, in which both types of dentation exist, though in this the teeth are usually longer than in the majority of specimens, but it is not abnormal and the passage to the usual condition is perfect.

It seems scarcely necessary to expand these notes of characters and variation further. Quelch has made extremely interesting remarks in his report on the Challenger reef corals (pp. 91–94). He recognizes *Mæandrina labyrinthica*, *Mæandrina sinuosissima*, and *Mæandrina strigosa*, with the remark that *sinuosissima* may be only "a very thick and hard triangular walled variety" of *strigosa*. I go further than he and place the *labyrinthica* or *labyrinthiformis* in the same species, but three usually good varieties may be recognized, in the line of Quelch's separation into three species.

This species can be defined only in terms of its variation. One character seems absolutely invariable, i. e., the form of the upper surface; it is uniformly rounded and never thrown into gibbosities.

There is one large, fine specimen in the collection from Mayaguez, Porto Rico. It is a uniformly rounded head, with no gibbosities, 35 cm. high and 52.5 cm. in diameter. The base is flattish. The valleys are very long and usually sinuous, width from 5 to 8 mm., usually 6 mm. wide, depth 4 mm. or less. The collines may be rounded or subacute, wall between series is thick or thin along the summit, compact and usually stout. The number of septa to the centimeter is variable; a common scheme is about 14 large septa, with a varying number of smaller ones. In one instance there are 14 large and 13 small, in another 14 large and 7 small, in another 17 large and no small. The septal dentations are strong, acute saw-toothed, and fairly regular. The paliform lobes are well developed. Columella fairly well developed, spongy, sometimes showing a lamellar element along the middle.

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[1] Mem. Mus. Comp. Zool., vol. VII, No. 1, 1880.

Family AGARICIDÆ Verrill.

Genus SIDERASTREA de Blainville, 1830.

The synonymy of this genus is fully considered in my Eocene and Lower Oligocene Corals of the United States.[1]

Siderastrea radians (Pallas). Pl. xv; pl. xvi, fig. 2.

1766. *Madrepora radians*, Pallas, Elench. Zooph., pp. 322–323.
1767. *Madrepora astroites*, Linnæus, Syst. Nat., ed. xii, p. 1276, non Pallas, 1766.
1786. *Madrepora galaxea*, Ellis & Solander, Nat. Hist. Zooph., p. 168, pl. xlviii, fig. 7.
1801. *Astrea galaxea*, Lamarck, Syst. Anim. s. Vert., p. 371.
1815. *Astraea radians* seu *astroites*, Oken, Lehrb. Naturgesch., Bd. 1, p. 65.
1830. *Astrea* (*Siderastrea*) *galaxea*, de Blainville, Dict. Sci. Nat., t. lx, p. 335.
1834. *Astræa astroites*, Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 319. Non *Explanaria galaxea* Ehrenberg = *Cyphastræa savignyi* Milne-Edwards & Haime.
1846. *Siderina galaxea*, Dana, Zooph. Wilkes Expl. Exped., p. 218, pl. x, figs. 12, 12*b*, 12*c* (non figs. 12*a*, 12*d*).
1880. *Siderastræa galaxea*, Pourtalès, Mem. Mus. Comp. Zool., vol. vii, pt. 1, pl. xi, figs. 14–21, pl. xv, figs. 1–12.
1895. *Astræa radians*, Gregory, Quart. Jour. Geol. Soc. Lond., vol li, p. 277.

Linnæus described a *Madrepora astroites* in Systema Naturæ, ed. x, p. 796, but the description is not sufficient for even approximate identification. The only reference in the synonymy that I have been able to verify is the one to Sloane's Jamaica (vol. i, p. 54, pl. xxi, *Lapis astroites s. stellaris*). I can not identify this figure. When Pallas's description of *M. radians* is taken together with Seba's figures (pl. cxii, figs. 12, 14, 17, 18), one can be reasonably sure of the identification being correct. The *Madrepora astroites* of the twelfth edition of Linnæus is the same as the *M. radians* of Pallas. It appears to me that *astroites* of Linnæus must be dropped altogether, and that *radians* of Pallas must be adopted.

There is one excellent specimen of this species in the collection from Mayaguez. It is an explanate mass, subquadrangular in horizontal outline; the greatest distance across is about 11 cm., lesser about 10 cm., and about 2 cm. thick.

Siderastrea siderea (Ellis & Solander). Pl. xiv, fig. 1, 2; pl. xvi, fig. 1.

1786. *Madrepora siderea*, Ellis & Solander, Nat. Hist. Zooph., p. 168, pl. xlix, fig. 2.
1816. *Astrea siderea*, Lamarck, Hist. Nat. Anim. s. Vert., t. ii, p. 267.
1830. *Astrea* (*Siderastrea*) *siderea*, de Blainville, Dict. Sci. Nat., t. lx, p. 335.
1834. *Astræa tricophylla*, Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 319 (*fide* Milne-Edwards & Haime).
1846. *Paronia siderea*, Dana, Zooph. Wilkes Expl. Exped., p. 331.
1850. *Siderastrea siderea*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ième sér., Zool., t. xii, p. 141.
1857. *Astræa siderea*, Milne-Edwards & Haime, Hist. Nat. Corall., t. ii, p. 509, pl. D7, fig. 2.
1863. *Siderastræa crenulata* var. *antillarum* Duncan, Quart. Jour. Geol. Soc. London, vol. xix, p. 435.
1863. *Siderastræa grandis*, Duncan, op. sup. cit., p. 441, pl. xvi, figs. 5*a*, 5*b*.
1871. *Siderastræa siderea*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. iv, p. 81.
1895. *Astræa siderea*, Gregory, Quart. Jour. Geol. Soc. London, vol. li, p. 278.

Gregory places *Siderastrea globosa* Milne-Edwards & Haime doubtfully in the synonymy of this species. From the original description of the species I would judge that it is not a synonym of *S. siderea*. *Siderastræa stellata* of Verrill, from Brazil, is a distinct species, and does not belong in the synonymy of *S. siderea*. It usually possesses four complete cycles of septa, but in most of its characters it resembles *S. radians* more closely. The upper portions of the septa are flattened, as in the latter species. The calices may form short series, sometimes are even meandriform. The examination of a large suite in the U. S. National Museum leads me to the conclusion that it is a valid species.

There are two splendid specimens of *S. siderea* in the Porto Rican collection. The larger is a head, possessing a greater diameter of about 20 cm., a lesser of about 14 cm., and a height of 15+ cm. The specimen grew over the surface of a mass of the same species and the thickness of this mass is included in the measurement of the thickness of the specimen.

Usually the leading distinction between *Siderastræa radians* and *Siderastræa siderea* is considered to be that the latter possesses four complete cycles of septa, whereas the former has the fourth cycle incomplete. This distinction is especially useful when only specimens for sectioning can be procured, such as those from elevated coral reefs. But there are other differences probably more important.

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[1] Mon. U. S. Geol. Sur., No. xxxix, 1900, p. 154. See also "Some fossil corals from the elevated reefs of Curaçao, etc. Samml. des Geolog. Reichs. Mus., Leiden, ser. ii, Bd. ii, Heft 1, Leiden, 1901, pp. 60, 61.

S. radians.	S. siderea.
Upper portion of the septal margins, between calices, flat.	Subacute.
Calices deformed; occasionally subhexagonal or rounded.	Subhexagonal.
Corallites, diameters 3 mm. by 2 or 2.5 mm., or even smaller.	Five mm. by 4 or 4.5, occasionally only 3 or 3.5 mm. in diameter.
Calicular fossa, septal margins perpendicular to horizontal plane through bottom of calice.	Septal margins slope to the bottom of the calicular fossa.
Septa, fourth cycle incomplete.	Fourth cycle nearly always complete.
Columella, solid.	Papillary.

The characters that first strike one's eye are the relatively smaller calices of *radians*, their more deformed outlines, and the flatness of the upper portions of the septal margins between calices. Besides, *radians* seems to be more explanate in mode of growth and to form smaller masses. *S. siderea* quite often forms rather large heads.

From Culebra.

Genus AGARICIA Lamarck, 1801. (= UNDARIA + MYCEDIUM, Oken, 1815.)

Agaricia elephantotus (Pallas). Pl. XVII, fig. 1.

1776. *Madrepora elephantotus*, Pallas, Elench. Zooph., p. 290.
1786. *Madrepora cucullata*, Ellis & Solander, Nat. Hist. Zooph., p. 157, pl. XLII (both figures).
1791. *Madrepora cucullata*, Esper, Pflanzenth. Fortsetz., Th. I, p. 83, pl. LXVII (figs. copied from Ellis & Solander).
1801. *Agaricia cucullata*, Lamarck, Syst. Anim. s. Vert., p. 373.
1815. *Mycedium elephantotus*, Oken, Lehrb. Naturgesch., Zool., Th. I, p. 69.
1815. *Mycedium cucullatum*, Oken, op. sup. cit., p. 69.
1846. *Mycedia cucullata*, Dana, Zooph. Wilkes Expl. Exped., p. 339.
1851. *Mycedium elephantotus*, Milne-Edwards & Haime, Ann. Sci. Nat., 3ième sér., Zool., t. XV, p. 131.
1860. *Mycedium elephantotus*, Milne-Edwards & Haime, Hist. Nat. Corall., t. III, p. 74.

Gregory places *Mycedia fragilis* Dana in the synonymy of this species, but so far as my observations go the two are distinct.

One young specimen in the collection is referred to this species. It is a thin lamina; the greater distance across is 38 mm., and the lesser 26 mm. The parent corallite is not situated centrally, but near one edge, on the lowest part of the lamina, i. e., it is sunken. The specimen does not agree precisely with the characterization given by Milne-Edwards & Haime. In one calice there are ten large, exsert, equal septa; in each of three loculi between pairs of these larger septa are three septa, one larger septum with a smaller septum on each side; in each of the remaining seven loculi is one small septum. The total number of septa is twenty-six. The larger septa are prominent, especially around the calicular fossa. This specimen agrees with the figure given by Ellis & Solander.

From station 6090, off Culebra, Culebritas light-house. Bathymetric occurrence, 16 fathoms.

Agaricia sp. Pls. XVIII, XIX.

This is a unifacial *Agaricia*, exhibiting features similar to those of *Madrepora undata* Ellis & Solander, *Agaricia agaricites* (Linnæus), and *Agaricia elephantotus* (Pallas). My opinion is that it should be referred to *A. agaricites* and probably placed in var. *undata* of Ellis & Solander.

The following is the description of *Madrepora undata*:

"Madrepora foliacea explanata concatenata, stellis serialibus, ambulacris intra stellas elevatis: carinis rotundatis crassis. Tab. 40. Corallium latum, planum, elegantissimum, album, subtus subtilissime striatum. Stellæ oblongæ: centra oblonga, subsoluta, elevata. Ambulacra extra stellas depressa, planiuscula, tandem intra seriem stellarum elevata in carinas crassas rotundatas."

In the largest specimen the distance between calicinal centers in a series is usually about 3 mm.; the distance from the top of a ridge below a series to the top of a ridge below the next series varies from 5 to 9 mm. The septa and septo-costæ are usually rather regularly alternately larger and smaller, around a calicinal center from 10 to 20 larger and as many smaller, but the larger are not so prominent as in *A. elephantotus*. The edges of this specimen are somewhat reflected, and that may have an influence on the appearance of the series.

The most striking differences between it and the usual *Agaricia agaricites* are: The distance between collines in the latter is usually not so great, from 4.5 mm., or even less, to about 6 mm.; the summits of the collines in *A. agaricites* are usually more acute; and there are in *A. agaricites*, usually, not so many septa to the calice, about 13 large and as many small. The laminate corallum of *A. agaricites* is usually thicker.

The specimen here discussed corresponds well to Milne-Edwards & Haime's characterization of *Mycedium elephantotus*, but it does not agree with the characterization by Pallas or the figure given by Ellis & Solander.

From station 6090, off Culebra, Culebritas light-house. Bathymetric occurrence, 16 fathoms.

Agaricia cailleti (Duchassaing & Michelotti). Pl. xx.

1866. *Mycedium cailleti*, Duchassaing & Michelotti, Sup. Mém. Corall. Ant., p. 93 (of reprint).
1874. *Mycedium cailleti*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. VIII, p. 44, pl. IX, figs. 1, 2.

Gregory[1] places this species in the synonymy of *A. elephantotus* with the remark that it appears to be a deeper water variety of the typical *A. elephantotus*. The suites of specimens in the United States National Museum do not show intergradation; therefore I have kept the two forms separate. The distinguishing feature of *A. cailleti* is, the fronds are dissected and the divisions are crispate. The calices are unifacial.

From station 6079, off St. Thomas, Sail Rock. There are seven good specimens of this species in the collection. Bathymetric occurrence, 20 to 23 fathoms.

Genus BATHYACTIS Moseley, 1881.[2]

Bathyactis symmetrica (Pourtalès). Pl. I, figs. 7, 7*a*, 7*b*.

1871. *Fungia symmetrica*, Pourtalès, Ill. Cat. Mus. Comp. Zool., No. IV, p. 46, pl. VII, figs. 5, 6.
1881. *Bathyactis symmetrica*, Moseley, Deep sea Corals, Challenger Reports, pp. 186–190, 2 figs. in text, pl. x, figs. 1–13 *a*.

The diameter of an average-sized specimen is 8.8 mm. The base is imperforate, horizontal, with distinct but not very prominent costæ corresponding to all septa. The six costæ of the first cycle are slightly larger than those of the second, those of the third are still smaller, and those of the fourth are very small. The members of the first and second are prolonged to the center of the base. The wall is thin and is minutely granulated, even between the costæ. The septa are imperforate in six distinct systems, and each system contains four cycles. The members of the first cycle are independent of the other septa and join directly to the columella. The members of the second cycle are also prolonged to the columella. The members of the third cycle fuse to the sides of those of the second quite near the columella, and those of the fourth fuse to the sides of the third a little nearer the wall than the columella. Thus there is a distinct group of septa between each pair of septa of the first cycle. The septal margins are spinosely dentate, the dentations somewhat flattened in a plane perpendicular to the septal plane. There may be granulations on the dentations. The fusion of the septa into groups is affected by synapticula, but the synapticula are not confined to those places. They are fairly abundant.

The calicular fossa is shallow. There is a small, weak, insignificant false columella.

Five specimens were obtained by the Fish Commission, all in very good condition.

It seems to me that Pourtalès's *Anthemiphyllia patera*, whose systematic position has been much debated, probably is closely related to this species.

From station 6069, Mayaguez Harbor. Bathymetric occurrence, 223 to 231 fathoms.

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[1] Quart. Journ. Geol. Soc. London, vol. LI, 1895, p. 281.

[2] After this paper had gone to press it was discovered that *Bathyactis symmetrica* had been wrongly designated "*Diaseris*" *crispa*. Page 311 was courteously reprinted by the Government Printing Office, but it will be necessary for the reader to make the following additional corrections: On p. 290, line 16, for *Diaseris* read *Bathyactis;* p. 290, line 17, for "*Diaseris*" *crispa* read *Bathyactis symmetrica;* p. 291, line 22 in table, for *Diaseris crispa Pourtalès* read *Bathyactis symmetrica* (*Pourtalès*); p. 319, under pl. I, after fig. 7, 7*a*, 7*b*, for *Diaseris crispa Pourtalès* read *Bathyactis symmetrica* (*Pourtalès*); pl. I, in legend at bottom, for "*Diaseris*" read *Bathyactis*.

Family ISOPORIDÆ, nom. nov.

This name is proposed to take the place of *Madreporidæ*.

Genus ISOPORA Studer, 1878.

1758. *Millepora* (pars), Linnaeus, Syst. Nat., ed. x, p. 790.
1766. *Madreporae anomalæ* (pars), Pallas, Elench. Zooph., p. 279.
1767. *Madrepora* (pars), Linnaeus, Syst. Nat., ed. XII, p. 1272.
Also, in part, of Esper, Pflanzenthiere; Ellis & Solander, Natural History of Zoophytes; and Lamarck, Système des Animaux sans Vertèbres.
1816. *Madrepora*, Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 277.
1834. *Heteropora*, Ehrenberg, Cor. Roth. Meer., Abhandl. K'gl. Akad. Wiss. Berlin for 1832, p. 323 (non de Blainville).
1878. *Isopora* (as subgenus), Studer, Monatsber. Akad. Wiss. Berlin 1878, p. 535.
1893. *Eumadrepora, Odontocyathus, Polystachys, Lepidocyathus, Isopora, Tylopora, Conocyathus, Rhabdocyathus* (as subgenera), Brook, Cat. Genus Madrepora, p. 22.

Brook has pointed out (op. cit., p. 22) that none of the species at present called *Madrepora* were included in the Linnaean *Madrepora*. The *Madrepora muricata* was placed in *Millepora*. What we now call *Madrepora* was subsequently inserted in the original Linnaean genus, and later the inserted part was made the type of *Madrepora* when it was subdivided. This is against all rules for nomenclature. The name *Madrepora* can not be employed as by Dana, Milne-Edwards & Haime, and later authors. *Heteropora* Ehrenberg can not be used, because de Blainville had previously applied the name to a genus of Bryozoa. The first available name known to me is *Isopora* Studer, applied in a subgeneric sense. I propose here to elevate it to generic rank. Studer included two species in it—*Madrepora labrosa* and *Madrepora securis*, both of Dana—designating neither one as a type.

The type species of *Madrepora* must be selected from the original list of species of Linnaeus, but I have not studied the generic history of all the species to determine the one to which the name *Madrepora* should be attached.

Isopora muricata (Linnaeus). Pls. XXI–XXVII.

1758. *Millepora muricata* (pars), Linnaeus, Syst. Nat., ed. x, p. 792.
1767. *Madrepora muricata* (pars), Linnaeus, Syst. Nat., ed. XII, p. 1279.
1893. *Madrepora muricata* (with synonymy), Brook, Cat. Gen. Madrepora, pp. 23-30.
1895. *Madrepora muricata*, Gregory, Quart. Jour. Geol. Soc. London, vol. LI, pp. 281-282.

After having examined very extensive suites of specimens of this species, and having studied the material in the British Museum and most of Duchassaing & Michelotti's types in Turin, I have reached the same conclusion as Brook, subsequently reiterated by Gregory, i. e., at present we know only one species of *Madrepora* from the West Indies, and this may conveniently be divided into three *formæ* or varieties, viz, *muricata* s. s. (*cervicornis*, Lam.), *prolifera*, and *palmata*.

I propose here to supplement what Brook has said on the early history of the nomenclature of this species.

The second reference given by Linnaeus in his original synonymy of *Millepora muricata*[1] is "Sloan jam. I, p. 51, t. 18, f. 3, corallium album porosum maximum muricatum." The full title of the work referred to is "A voyage to the Islands of Madera, Barbados, Nieves, S. Christophers and Jamaica, with the natural history of the herbs and trees, four-footed beasts, fishes, birds, insects, reptiles, etc., of the last of these islands; to which is prefixed an introduction wherein is an account of the inhabitants, air, water, diseases, trade, etc., of that place, with some relations concerning the neighboring continent, and islands of America. Illustrated with the figures of the things described, which have not been heretofore engraved; in large copper plates as big as the life. By Hans Sloane, M. D., in two volumes. London, 1709." This old book possesses a considerable number of fairly good figures of Jamaican corals. The figure to which Linnaeus makes reference, pl. 18, fig. 3, is the typical *Madrepora cervicornis* of Lamarck. Pallas[2] divides the species into three varieties: (α) Varietas *ramosa*, under which reference is made to Browne's Jamaica, Sloane's Catalogus Plantarum Insulæ Jamaicæ (London, 1891), and Sloane's Natural History of Jamaica. He also refers to Seba's Thesaurus. I do not know what pl. cviii, fig. 6, represents, but pl. cxiv, fig. 1, is the common *cervicornis*. Knorr's (Deliciæ Naturæ) pl. AII, fig. 1, also referred to by Pallas, is the same. Knorr's says, "Het is namentlyk dit eige zelve Koraal 't welk by Sloane Jamaica, Tab. xviii, fig. 3, onder den Naam van Corallium album porosum muricatum maximum gevonden werd, etc." (Op. cit., p. 6.) (*β*) Varietas *corymbosa*. Under this, reference is made to Browne's Jamaica, p. 391, No. 6, Madrepora maxima compressa, palmata and muricata. Browne's states, "This grows the largest of all the coralline substances found about Jamaica; it is met with in large single masses of an irregular compressed form, which spread into broad, flat lobes toward the top." (Op. et loc. cit.) Browne refers to pl. 18 of Sloane's Nat. Hist. of Jamaica, but he seems to me to mean pl. 17, fig. 3. (*γ*) Reference is made to Sloane's Natural History of Jamaica, vol. I, p. 58, n. 5, tab. 17, fig. 3, which is what is usually denominated *Madrepora palmata*. Pallas states "Locus: Mare Americanum & Indicum."

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[1] Syst. Nat., ed. x, 1756, p. 792.

[2] Elench. Zooph., 1766, pp. 327-331.

Linnæus in Syst. Nat., ed. xii, pp. 1279, 1280, again gives references showing that the West Indian forms were included in *Millepora muricata* now transferred to *Madrepora*, following Pallas. Ellis & Solander included the West Indian species in *muricata*. Their var. *α* is *cervicornis* Lam.; *δ* has for a synonym var. *β* of Pallas; *ε* is the *γ* of Pallas, or *palmata* Lamarck. Esper's *Madrepora muricata*[1] was composed of several species, but included the West Indian forms. In the Museum Calonnianum 1797, p. 68, usually credited to Humphreys, the name *muricata*, so far as I know, is for the first time attached definitely to the West Indian species. Dana, Milne-Edwards & Haime, and subsequent writers on corals until Brook have not used the name. Brook was entirely correct in his use of the name. The form hitherto usually called *cervicornis* should be the typical form of the species.[2]

Isopora muricata s. s. (=**cervicornis** Lamk.). Pl. xxi, and Pl. xxii, fig. 2.

Specimens of this forma are abundant. It is characterized by being loosely and diffusely branched. The branches are often very long. Pourtalès has published excellent figures in Agassiz's Florida Coral reefs.[3]

Collected off Gallardo Bank, tang. of Morillos de Cabo Rojo, ESE. ¼ E. 9⅓ miles, in 10 to 10½ fathoms of water.

Isopora muricata *forma* **prolifera** Lamarck. Pl. xxii, fig. 1; and Pls. xxiii, xxiv, xxv.

There are numerous specimens of this form. It differs from *cervicornis* by having more crowded branches, which often show indications of fusing into flabellate fronds. Culebra is one of the localities where this was found. The specimens represented by plates xxiii, xxiv and xxv, are from Dry Tortugas, Florida (Dr. Edw. Palmer, collector)

Isopora muricata *forma* **palmata** Lamarck. Pls. xxvi and xxvii.

Fine specimens of this forma were found at both Mayaguez and Culebra. The largest measures 91 by 55.5 cm. across. It is composed of several large fan-shaped masses.

It seems well to give here a somewhat full account of the variations of *Madrepora muricata*, and this can not be better introduced than by a quotation from Brook's[4] discussion of forma *palmata*.

"The majority of the specimens which have come under my notice do not suggest a very close affinity to the arborescent forms *prolifera* and *cervicornis*, and for some time I was inclined to regard them as distinct. Nevertheless a number of intermediate forms occur, chiefly in the collection of the British Museum, which appear to render it necessary to regard all as varieties of one species; and there appears little reason to doubt that the ultimate form of the corallum, whether flabellate or arborescent, is to a great extent dependent on the environment. Tracing the frondose and vasiform specimens, without branchlets, back to *M. prolifera*, the first step is seen in those specimens already referred to, in which the course of the branches composing the fronds is indicated by grooves in the surface. In other specimens the branches, though confluent, are well marked at the apex of the fronds, and an increase in the size of the axial corallites is generally observable in such specimens.

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[1] Pflanzenth. Fortsetz., pp. 45–59.

[2] J. E. Duerden has some interesting observations on the polyps of this species in Jour. Inst. Jam., vol. II, No. 6, 1899, pp. 621–622.

[3] Mem. Mus. Comp. Zoöl., vol. VII, No. 1, pl. XVIII, figs. 1-9 (all figs.), fig. 1 represents a typical branch.

[4] The genus Madrepora, 1893, pp. 25, 26.

Next in the series come two *Challenger* specimens from St. Thomas, which show the characters of *M. prolifera* so unmistakably that they were referred to that species by Quelch. In one of these the branches form a complanate but not solid frond; usually from 2 to 5 branchlets are collected together in flattened groups and fused together laterally; they vary from 7 to 12 mm. in thickness, including wall. Radial corallites spreading at an angle of about 45°, tubular, with an oblique aperture, or nariform, rather unequal, 1 to 3.5 mm. long, with immersed ones between, especially in the line of fusion. The other specimen has stouter and less confluent branches, with radial corallites which, in some parts, recall the condition characteristic of *M. cervicornis*."

I went over carefully, in the British Museum, all of the specimens upon which Brook based his notes, and it seemed to me that his conclusion was correct. I have had photographic illustrations made of a number of specimens, and give here a résumé of the features exhibited by them.

Pl. XXII, fig. 2, is the end of a branch, 20.5 cm. long, of the *cervicornis* variety, showing several branchlets. Pl. XXI represents a specimen, 37.5 cm. high, of the same forma. Pl. XXII, fig. 1, is the end of a branch of the *prolifera* variety, showing some branchlets slightly fused one to another. Pl. XXIV represents another specimen of *prolifera*, 39.5 cm. high, in which the branches and branchlets are somewhat crowded but remain separate. Specimen, pl. XXIII, also of *prolifera*, 35.5 cm. high, has the branches crowded and frequently fused one to another in the same plane. Pl. XXV represents still another specimen of *prolifera*, 51.3 cm. high, in which there is still greater fusion. As the illustration is only about one-half natural size, it does not show the fusion so forcibly as the specimen itself. Pl. XXVI represents a small specimen of *palmata*, greatest length 23.2 cm., which shows the courses of the small branches and the free ends of branches around the margin. Pl. XXVII represents a young specimen of *palmata*, breadth 14.8 cm. Even in this specimen faint indications of component, fused branches may be seen.

These plates, together with the quotation from Brook, will show how the transformation in form takes place. Forma *cervicornis* (*muricata* s. s.) stands at one extreme, and forma *palmata* stands at the other. The plates published by Pourtalès[1] form an interesting series for comparison in this connection.[2]

Family PORITIDÆ Dana.

Genus PORITES Link, 1807.

Porites porites (Pallas).

1756. ***Corallium, poris stellatis***, etc., Seba, Thes., t. III, p. 202, pl. CIX, fig. 11.
1766. ***Madrepora porites***, Pallas (pars), Elench. Zooph., p. 324.
1895. ***Porites clavaria***, Gregory, Quart. Jour. Geol. Soc. London, vol. LI, p. 282, with synonymy.

The reasons for the use of the specific name *porites* probably should be stated. The *Madrepora porites* of Pallas was not applied to what is now considered a species by any one, but would apply to any *Porites*. If his specific name is to be retained it must be restricted to some one species included in the original group of species. Milne-Edwards & Haime[3] place "*Madrepora porites* (pars) Pallas" in the synonymy of *Porites clavaria* Lamarck, and also place "Corallium poris stellatis, Seba, Thes. loc. rer. nat., t. III, p. 202, tab. CIX, No. 11" in the synonymy of the same species. Pallas in his synonymy of

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[1] Mem. Mus. Comp. Zool., vol. VII, No. 1, pls. XVII–XIX.

[2] Since this manuscript was prepared Prof. J. W. Gregory has published a paper entitled "On the West-Indian Species of Madrepora" (Ann. and Mag. Nat. Hist., 7th ser., vol. VI, No. 31, July 1900, pp. 20–31), in which he concludes that the three traditional species of *Madrepora* should be recognized, considering that he was mistaken in the opinion expressed in his "Contributions to the Palæontology and Physical Geography of the West Indies." From the evidence presented in my own discussion of the subject, I have arrived at the same conclusion as Brook, i. e., it seems to me that the three do intergrade. However, I believe in the retention of the three usually recognized forms of the species. Whether these three forms should be called species, forms, varieties, or subspecies depends upon the individual definitions of these words. In my opinion the proper treatment is to consider all of these *forms* as one species, because of intergradation, and that as the forms are usually distinct they should be differentiated and designated by names of value subordinate to that of the name species. On the other hand, if the existence of not very numerous specimens indicating intergradation is not considered sufficient to overthrow a species, the three forms should be considered species. The question is very largely one of nomenclature. Such discussions as that of Gregory, the one given by Duerden in the Jour. Jamaica Institute, vol. II, No. 6, 1899, pp. 621, 622, and the one given here by myself aid in understanding the biology of these forms, no matter by what nomenclature they are designated. Duerden could find no difference in the polyps of the three forms.

I have recently seen, in possession of a curio vender at Palm Beach, Florida, a collection that bridges completely any imaginable gap between *prolifera* and *palmata*.

[3] Hist. Nat. Corall., t. III, 1860, p. 175.

Madrepora porites cites this same reference to Seba. I have, therefore, seized upon the "*Corallium, poris stellatis*" of Seba as the type of *Porites porites* (Pallas). Seba states that the coral is found on the shores of Curaçao.

I have recognized only one species of branching *Porites* in the West Indian region, considering all specimens that show intergradation as belonging to the same species. Practically the same conclusion was reached by Rathbun.[1] Pourtalès states "*Porites clavaria* and *furcata* are * * * rather difficult to distinguish by any constant characters derived from the calicle, as they vary considerably in the same specimen."[2] Gregory (op. et loc. sup. cit.) has combined what were divided into two species. I find the treatment accorded the species by Rathbun excellent, and invite especial attention to what he has written (sup. cit.). The variation of this species is enormous. By taking individual colonies or isolated specimens from separate localities, the number of "species" could be multiplied indefinitely. Pl. XXIX, and pl. II, fig. 4, represent almost the extremes. A considerable number of fairly well characterized varieties may be recognized. I have accordingly divided the specimens from Porto Rico into three "*formæ*," and have illustrated each of them.

When I employ the specific designation *Porites porites* (Pallas) without placing the name of a forma or variety after, it will apply to any of the branching *Porites* from the West Indian region with the special septal arrangement later described. Usually, however, the particular forma of the species will be indicated.

I had hoped to find in the U. S. National Museum a specimen of *Porites* from Curaçao that would be practically a duplicate of the specimen figured by Seba, but could find none, though there are some from Florida. We have from Curaçao a specimen that agrees fairly well with Seba's figures, except the branches are more crowded. It is represented on pl. XXVIII by illustrations from photographs. It can scarcely be referred to any one of the three formæ recognized in the Porto Rican collection, but resembles *furcata* more closely than it does *clavaria*. The calicular structure is more pronouncedly of the *furcata* type. There are either five or six pali, but without taking a precise census five seems to be the more common number. Six is the usual number on the lower portion of the living part of the corallum, while five is the usual number on the ends of the branches. The calices are superficial except near and on the ends of the branches, where they are fairly deep. Twelve seems to be the constant number of septa. The calices show a bilateral symmetry. At one end of the plane of symmetry is a free septum joining directly the "columellar tangle";[3] at the other is a septum with a septum on each side of it and bending toward it. There are four other septa on each side of the plane of symmetry. They are fused together and to "the columella tangle" in pairs. This arrangement is not constant. In one calice there are two groups of three septa each and three groups of two septa each, without apparent bilateral symmetry, but this arrangement can be easily derived from the usual condition by the solitary directive septum joining to an adjacent pair of septa. This would make the asymmetry apparent but not real. There is a palus before each group of septa, and often there is also a palus before the solitary directive. The columella shows three conditions—the columellar axis may be open, there may be a spongy columella, or the columella may be terminated above by a tubercle. The wall is wide and flattish on the older portions of the colony and thin and acute on the younger portions on the ends of the branches. The usual diameter of the calices is 1.5 to 2 mm.

This specimen has been described in considerable detail, because it may be regarded as something like a type of the species—it is a topotype.

The calicular structure of this Curaçaoan specimen and that of the three formæ subsequently recognized show the same range in variation, i. e., number and arrangement of septa, characteristics of pali, and character of columella. Usually forma *clavaria* has the columella terminated above by a tubercle, but not always; in forma *furcata* there may or may not be a columellar tubercle; the same is true of forma *divaricata*. These notes on variation are based not upon comparing different specimens but upon comparing the calices of the same specimen.

The description of the calicular structure will not be repeated in discussing the formæ.[4]

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[1] Cat. Poritidæ, Proc. U. S. Nat. Mus., vol. X, 1887, pp. 356–357

[2] Ill. Cat. Mus. Comp. Zool., No. IV, 1871, p. 85.

[3] This expression is borrowed from Bernard.

[4] Two interesting papers on the arrangement and development of septa in *Porites* should be cited: H. M. Bernard, "On the Structure of Porites, with Preliminary Notes on the Soft Parts," Journ. Linn. Soc. Lond., vol. XXVII, 1900, pp. 487-516, pl. 35 (fig. 5, p. 492, gives a diagram that applies to the septal arrangement of *Porites porites*); J. E. Duerden, "Order of Appearance of the Mesenteries and Septa in Madreporaria," Johns Hopkins Univ. Circ., vol. XIX, No. 146, June, 1900, pp. 47–53.

Gregory has omitted the names of three species that should be placed in this synonymy. *Porites polymorphus* Link[1] is simply a new name for *Madrepora porites* of Pallas. Reference is made to pl. xxi of Esper, which belongs in the *Porites clavaria* group of Lamarck, pl. xxi A is different. The genus *Porites* does not date from Lamarck 1816, but from Link 1807. The type species is *Madrepora porites* Pallas, here restricted and called *Porites porites* (Pallas). Lamarck did not use *Porites* in his Système des Animaux sans Vertèbres, 1801. The other species omitted by Gregory are *Porites valida* Duchassaing & Michelotti,[2] and *Porites nodifera* Klunzinger.[3] Rehberg in his "Neue und wenigbekannte Korallen"[4] says that Klunzinger's *P. nodifera* is probably the same as *P. clavaria*, and that the locality, Red Sea, as given by Ehrenberg and Klunzinger, is erroneous. I studied carefully the figured type of *nodifera* in the Museum für Naturkunde, Berlin, and in my opinion *nodifera* and *clavaria* are the same, and it seems to me most probable that Rehberg's suggestion as to the wrong locality label becoming attached to the specimen is correct.

I have divided this species, as represented by Porto Rican specimens, into three formæ, viz, *clavaria* and *furcata*, both of Lamarck, and *divaricata* Le Sueur. The Porto Rican specimens do not show intergradation between the three formæ, but the splendid suites in the United States National Museum show the perfect passage of one form into another.

Porites porites *forma* **clavaria** Lamarck. Pl. xxix and Pl. xxxi, fig. 2.

There are five specimens of the form, either complete colonies or fragments. Pl. xxix, represents one of the specimens and pl. xxxi, fig. 2, the calices enlarged. There are no indications in these specimens of an intergradation with forma *furcata*, the larger size and especially the more swollen and blunter ends of the branches being the most salient difference from the latter. But the calices also are usually different. They are shallow, deeper on the ends of the branches, and are usually 2 mm. in diameter. A columella, represented by a tubercle and surrounded by six pali, is usually present. On the ends of the branches, where the calices are deeper, the pali are not so well developed.

The septa are perforate lamellæ, as Bernard has described them.[5] The height to which the epitheca rises is so variable that no importance is attached to it.

From Ensenada Honda, Culebra.

Porites porites *forma* **furcata** Lamarck. Pl. xxx and Pl. xxxi, fig. 1.

The branches of this species are more slender than in *clavaria*. The calices are smaller, 1.5 mm. in diameter. No absolute distinction can be made based on the calicular structure, but usually in *furcata* there are only five pali.

From Ensenada Honda, Culebra.

Porites porites *forma* **divaricata** Le Sueur. Pl. ii, figs. 4, 4*a*, 4*b*.

Twenty specimens of a delicate species of *Porites* were collected at station 6087, off Culebra, Point Mula light-house, in 15¼ fathoms of water. These at first appeared to me so different from the other specimens that I thought they certainly belonged to a distinct species. From a comparison with the large suites of forma *furcata* in the United States National Museum they now seem to me to intergrade with forma *furcata*, *divaricata* being much more delicate. The figures show the characters well. The most salient characteristic is the small diameter of the branches, the largest being only 6 mm. in diameter. The diameter, too, is almost the same at the distal end as at the origin of the branch. The calices are very shallow, 2 mm. in diameter. The wall is narrow, flattish, or subacute.

The specimens were associated with *Oculina diffusa*, *Axhelia mirabilis*, and *Meandrina mæandrites*? young.

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[1] Beschreib. Natur. Samml., Rostock, 1807, p. 162.

[2] Sup. Mém. Corall. Ant., p. 94 (of reprint), pl. x, fig. 13.

[3] Die Korallenthiere des Rothen Meeres, pt. ii, p. 41.

[4] Abhandl. Naturwiss. Ver. Hamburg, Bd. xii, 1892, p. 47.

[5] Jour. Linn. Soc. London, vol. xxvii, 1899, p. 137.

Porites astreoides Lamarck. Pls. XXXII, XXXIII, XXXIV.

1816. *Porites astreoides*, Lamarck, Hist. Nat. Anim. s. Vert., t. II, p. 269.
1829. *? Porites conglomeratus*, Eichwald, Zool. Spec., p. 183.
1861. *Porites incerta*, Duchassaing & Michelotti, Mém. Corall. Ant., p. 83 (of reprint).
1861. *Porites guadalupensis*, Duchassaing & Michelotti, op. sup. cit., p. 83.
1861. *Porites agaricus*, Duchassaing & Michelotti, op. sup. cit., p. 83.
1863. *Porites collegniana*, Duncan, Quart. Jour. Geol. Soc. London, vol. XIX, p. 437 (non Michelin, 1842).
1866. *Neoporites littoralis*, Duchassaing & Michelotti, Sup. Mém. Corall. Ant., p. 97 (of reprint).
1866. *Porites michelini*, Duchassaing & Michelotti, op. sup. cit., p. 98, pl. X, figs. 9, 10.
1866. *? Porites subtilis*, Duchassaing & Michelotti, op. sup. cit., p. 98, pl. X, figs. 7, 8.
1866. *Porites superficialis*, Duchassaing & Michelotti, op. sup. cit., p. 99.
1866. *Cosmoporites lævigata*, Duchassaing & Michelotti, op. sup. cit., p. 99, pl. X, figs. 12, 16.
1868. *Porites solida*, Verrill, Trans. Conn. Acad. Sci., vol. I, p. 358.
1880. *Porites astræoides*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, No. I, pl. XVI, figs. 1-12.
1892. *Porites verrilli*, Rehberg, Abhandl. Naturwiss. Ver. Hamburg, Bd. XII, p. 48.

Ehrenberg's *Madrepora* (*Porites*) *astræoides* is not a *Porites* but is a *Stylophora*, *St. ehrenbergi* Milne-Edwards & Haime.[1]

The only point in the synonymy of this species demanding especial consideration is the treatment accorded the species of Duchassaing & Michelotti. I found in Turin the types of five of the eight species described by these authors, viz. *littoralis*, *superficialis*, *guadalupensis*, *incerta*, and *agaricus*. I could not discover differences of sufficient importance to establish even varieties. There remain *Neoporites michelini*, *N. subtilis*, and *Cosmoporites lævigata*, all of which are figured; besides, the names are accompanied by poor, brief Latin descriptions. Neither the descriptions nor figures show any characters of value, unless it be in the figure of the calice of *subtilis* showing a greater number of septa than in the other species.

Pourtalès has published superb figures in Agassiz's Florida Reef Corals (Mem. Mus. Comp. Zool., vol. VII, No. 1, 1880).

Two species grouping with *astreoides* remain to be considered, viz. *Porites solida* Verrill (non *solida* Forskal) = *P. verrilli* Rehberg,[2] and *Porites branneri* Rathbun. The former, *P. verrilli* Rehberg, must in my opinion be placed in the synonymy of *P. astreoides*. There are several excellent specimens in the United States National Museum from Rio Formosa, Pernambuco, Brazil (collected by the Hartt Expedition, 1875). These specimens have the same general appearance as *astreoides*. The only feature that could be used for specific differentiation is the usually constant presence of a solid columella, which may have a small slight styliform projection in the center. There are twelve septa, no pali, and the wall is as in *astreoides*. The difficulty about using the difference of the columella as of specific value is that in the specimens of *verrilli* it shows variation in the degree of compactness, while in *astreoides* we can find in the same specimen the typical *verrilli* condition or a weak style with very little or no basal deposit around it. There can be no varietal difference.

Porites branneri Rathbun seems to be a distinct species. There are in the United States National Museum several specimens from Pernambuco, Brazil (Hartt Exp., collector). The species grows in small, incrusting masses. The calices are smaller than is common in *astreoides*, but the distinguishing feature is the constant presence of five pali: they are rather slender and erect. The columella space is usually vacant, sometimes a "columellar tangle" is present. The species needs further study, for it suggests the young colony of *Porites porites* (Pallas).

In *P. astreoides* the usual number of septa is twelve, but sometimes rudimentary septa are present between the larger.

There are six excellent specimens of this species, which may be divided into two formæ.

Forma α, Pl. XXXII and Pl. XXXIV, fig. 1.—To this form four of the specimens belong. It is especially characterized by the surface of the corallum possessing numerous gibbosities. Certain features of the specimens belonging to this form may with propriety be described in some detail. The edge of the wall between the corallites is acute; the calices are rather deep. The diameter of the calices is 1.5 to 2 mm. There are usually twelve large septa with rudimentary or smaller septa quite often between them. The septal margins are dentate; the septa themselves are perforate.[1] The columella is represented by a small tubercle or lamina.

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[1] Hist. Nat. Cor., t. II, p. 139.

[2] Neue und wenig bekannte Korallen, Abhandl. Naturwiss. Ver. Hamburg, Bd. XII, pt. 1892, I, p. 48.

Forma β, Pl. XXXIII and XXXIV, fig. 2.—This form is represented by two specimens. Its most striking peculiarity is the fewness of gibbosities, but correlated with this character are others. When the surface is gently rounded, the calices are smaller than in forma α, being only 1 mm. in diameter, the walls separating the corallites are often not so acute as in forma α, and the calicular fossa resembles a pit with a perpendicular boundary. It at first sight seems that two distinct species are represented, but there are gibbosities present in forma β, and upon these the calicular characters of forma α appear. The calices here are larger, between 1.5 and 2 mm. in diameter, the separating wall between adjoining calices acute, etc. These specimens are a good illustration of the possibility of dividing one species into two, should only portions of the surface of the coralla be studied. They illustrate, too, the influence of form of growth upon the size and other characters of the calices. While the calices on the gibbosities are large, those situated in the depressions between them are small, only a millimeter or even less in diameter.

The actual arrangement of the septa of *Porites astreoides* forma α is similar to that of *P. porites*, i. e., there is a solitary directive septum with a group of three septa opposite, and besides these there are four pairs of septa, two pairs on each side of the plane of symmetry, except that the septa of the group of three remain free one from another and are prolonged to the columella each independently; the outer two septa of those three bend toward the included one. Twelve is the usual number of septa, though sometimes there may be a few more. The arrangement of the septa, columella, etc., are frequently the same in both formæ α and β. As the calices of the latter are usually deeper than in the former, a photograph did not bring out the structural features clearly. Pali are poorly developed or absent.

Classifying the calicular structure according to Bernard's[2] scheme, which has been already referred to, the usual plan is represented by his fig. 2 or is intermediate between figs. 1 and 2.

In forma α the condition represented by fig. 1, where the inner margins of all septa are free one from another, was not found, but in some calices the fusion was slight; fig. 2 represents the usual condition; the condition represented in fig. 4 was found in a few instances, but the pali were poorly developed. In forma β the condition represented by fig. 1 is frequently approached very closely, if not actually present; that of fig. 2 is represented; and that of fig. 4 is hinted at, but not clearly present.

Bernard has published some notes on the calicular structure of *P. astreoides* in his paper already cited on the calices of the genus.[2]

Class HYDROZOA.

Order HYDROCORALLINÆ Moseley.[3]

Family MILLEPORIDÆ L. Agassiz.

Genus MILLEPORA Linnæus, 1758.

Millepora alcicornis Linnæus. Pl. XXXV–XXXVIII.

1758. *Millepora alcicornis*, Linnæus, Syst. Nat., ed. X, p. 791.
1880. *Millepora alcicornis*, Pourtalès, Mem. Mus. Comp. Zool., vol. VII, No. I, pl. XX, figs. 1–6 (all figs.).
1898. *Millepora alcicornis*, Hickson, Proc. Zool. Soc. London, for 1898, p. 256 (*vide* pp. 245–257).

Hickson (op. et loc. sup. cit) has given a lengthy discussion of the synonymy of this species. Following him I have not recognized more than one species of *Millepora* in the West Indies. Two distinct forms, as determined by the shapes of the coralla, are represented in the collection; one possesses a solid and palmate corallum, and the other has the corallum dissected, with some digitiform projections. Both forms are shown in the plates.

From Mayaguez and Culebra.

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[1] Bernard's characterization of the septa of *Porites* as "perforate lamellate septa" (Jour. Linn., vol. XXVII, 1899, p. 137) is correct.

[2] Op. sup. cit., p. 492.

[3] These, although they are not corals, are included because they are among the commonest of the reef-building animals of the Porto Rican waters.

EXPLANATION OF PLATES.

Plate I:

Figs. 1, 1*a*, *Paracyathus de filippii* Duchassaing & Michelotti. Fig. 1, upright view of corallum; height, 7 mm. Fig. 1*a*, calicular view; greater diameter of calice, 6.5 mm.

Figs. 2, 2*a*, *Deltocyathus italicus* (Michelotti), var. *calcar* Pourtalès. Copied from Lindström. [Actinology of the Atlantic Ocean, pl. I, fig. 13, and pl. II, fig. 14.] Fig. 2, view of base. Fig. 2*a*, calicular view. Lindström does not give the size of the specimen or indicate the magnification of his figures; judging from his text, the diameter is probably 8 mm. (exclusive of the horns).

Figs. 3, 3*a*, *Axhelia mirabilis* (Duchassaing & Michelotti). Fig. 3, general view of a branch; greatest length, 45 mm. Fig. 3*a*, view of a calice; greater diameter, 2 mm. The surface of the cœnenchyma is covered with elongate granules, which show a decided tendency to be arranged in striæ.

Fig. 4, *Axhelia asperula* (M.-Edw. & H.). Several calices enlarged; distance between columellar styles of the two calices farthest apart, 2.5 mm.; figure enlarged 8 times. The septal margins are exsert and on the tips of the branches the calicular margins are frequently considerably elevated.

Figs. 5, 5*a*, *Oculina diffusa* Lam., var. Fig. 5, general view of a branch; greatest length, 70 mm. Fig. 5*a*, calicular view of a corallite; greater diameter, 3 mm.

Figs. 6, 6*a*, 6*b*, *Astrangia solitaria* (Le Sueur)? var. *portoricensis* var. nov. Fig. 6, upright view of a single corallite; height, 13.5 mm. Fig. 6*a*, costæ and exsert portion of several septa enlarged. Fig. 6*b*, calicular view; greater diameter of calice, 7 mm.

Figs. 7, 7*a*, 7*b*, "*Diaseris*" *crispa* Pourtalès. Fig. 7, upright view of corallum; diameter, 9 mm. Fig. 7*a*, 1½ systems of septa, seen from above, enlarged; the Arabic figures 1 and 2 denote septa of the first and second cycles, respectively. Fig. 7*b*, view of the base.

Plate II:

Figs. 1, 1*a*, 1*b*, 1*c*, *Cyathoceras portoricensis*, sp. nov. Fig. 1, upright view of corallum; height, 22 mm. Fig. 1*a*, calicular view; greater diameter, 10 mm. Fig. 1*b*, profile of a large septum. Fig. 1*c*, costæ and exsert portions of several septa enlarged.

Figs. 2, 2*a*, 2*b*, *Astrangia astreiformis* M.-Edw. & H. Fig. 2, general view of a corallum; greatest distance across, 21.5 mm.; calicular view of a corallite; greater diameter, 5 mm. Fig. 2*b*, costæ enlarged; the costæ usually are more granulate and the septal margins are alternately more and less exsert.

Figs. 3, 3*a*, *Cladocora arbuscula* (Le Sueur). Fig. 3, general view of a portion of a corallum; greatest length, 33.5 mm. Fig. 3*a*, calicular view of a corallite; greater diameter of calice, 3.5 mm. (of corallite 4.5 mm.).

Figs. 4, 4*a*, 4*b*, *Porites porites* forma *divaricata* Le Sueur. Fig. 4, general view of a corallum; greatest length, 39 mm. Fig. 4*a*, two calices enlarged, distance across the two, 4 mm.; the letter *a* corresponds to letter *a* in fig. 4*b*; this calice possesses 5 pali and no columellar tubercle; the septal arrangement and the mode of occurrence of pali are diagrammatically represented by fig. 4*b*; the other calice possesses 5 pali and a columellar tubercle; between the pali and the wall on several septa are prominent septal granules, so it is not easy to distinguish the pali and columellar tubercle in the figure; the septal arrangement is the same in both calices.

Plate III: *Meandrina meandrites* (Linn.) ? Young. View from above; greatest length, 79 mm.

Plate IV:

Fig. 1, *Meandrina meandrites* (Linn.) ? Young. Upright view of corallum; greatest length, 79 mm.

Figs. 2, 3, *Manicina areolata* (Linn.). Fig. 2, calicular view. Fig. 3, upright view; greatest transverse measurement, 57 mm.

Plate V: *Meandrina dana* (M.-Edw. & H.). Figures from photographs of the types in the Muséum d'Histoire Naturelle, Paris.

Plate VI: *Orbicella acropora* (Linn.) var. General view of a corallum; 18.7 cm. high.

Plate VII: *Orbicella acropora* (Linn.) var. Calices enlarged; usual diameter of calices about 4.5 mm.; enlarged about 5 times.

Plate VIII: *Favia fragum* (Esper). Lower figure, view of a corallum from side; upper figure, view from above, more enlarged; greater transverse diameter of specimen, 2.85 cm.

Plate IX: *Platygyra viridis* (Le Sueur). General view of a large head; height, 35 cm.

Plate X: *Platygyra viridis* (Le Sueur). Valleys enlarged.

Plate XI: *Platygyra viridis* (Le Sueur). Portion of valleys represented by pl. X more highly enlarged.

Plate XII: *Platygyra viridis* (Le Sueur). Meandriform valleys enlarged.

Plate XIII: *Platygyra viridis* (Le Sueur). Portion of the valleys represented by pl. XII more highly magnified.

PLATE XIV: *Siderastrea siderea* (Ell. & Sol.):

Fig. 1, General view of a large specimen; greater horizontal diameter, 20.2 cm.

Fig. 2, View of the same specimen, from above.

PLATE XV: *Siderastrea radians* (Pallas). View of a specimen from above; greatest diagonal, 14 cm.

PLATE XVI:

Fig. 1, *Siderastrea siderea* (Ell. & Sol.). Calices enlarged.

Fig. 2, *Siderastrea radians* (Pallas). Calices enlarged.

PLATE XVII:

Fig. 1, *Agaricia elephantotus* (Pallas). View of a corallum from above; greatest width, 30 mm.

Fig. 2, *Axhelia asperula* (M.-Edw. & H.). General view of a specimen; height, 34.5 mm.

PLATE XVIII: *Agaricia* sp. General view of a corallum from above; width between extremes of projecting portions, 18.8 cm.

PLATE XIX: *Agaricia* sp. Portions of valleys, enlarged.

PLATE XX: *Agaricia cailleti* (Duch. & Mich.). General view of corallum; height, 7.7 cm.

PLATE XXI: *Isopora muricata* (Linn.) s. s. (= *cervicornis* Lamarck). Height of specimen, 37.5 cm.

PLATE XXII:

Fig. 1, *Isopora muricata* forma *prolifera* Lam. End of a branch; height, 9 cm.

Fig. 2, *Isopora muricata* Linn. Height, 20.5 cm.

PLATE XXIII: *Isopora muricata* forma *prolifera* Lamk., from Dry Tortugas, Florida. Height, 35.5 cm.

PLATE XXIV: *Isopora muricata* forma *prolifera* Lamarck, from Dry Tortugas, Florida. Height, 39.5 cm.

PLATE XXV: *Isopora muricata* forma *prolifera* Lam., from Dry Tortugas, Florida. Height, 51.3 cm.

PLATE XXVI: *Isopora muricata* forma *palmata* Lamarck. Greatest breadth, 23.2 cm.

PLATE XXVII: *Isopora muricata* forma *palmata* Lam. Breadth, 14.8 cm.

PLATE XXVIII: *Porites porites* (Pallas). Specimen from Curaçao. Height, 13.3 cm.; greatest breadth, 16 cm.:

Fig. 1, General view of corallum.

Fig. 2, Calices enlarged.

PLATE XXIX: *Porites porites* forma *clavaria* Lam. Height of specimen, 14.5 cm.

PLATE XXX: *Porites porites* forma *furcata* Lam. Extreme breadth of specimen, 26 cm.

PLATE XXXI:

Fig. 1, *Porites porites* forma *furcata* Lam. Calices enlarged.

Fig. 2, *Porites porites* forma *clavaria* Lam. Calices enlarged.

PLATE XXXII: *Porites astreoides* Lam., forma *α*. Horizontal diameter of specimen, 17.6 cm.

PLATE XXXIII: *Porites astreoides* Lam., forma *β*. Greater horizontal diameter, 20.6 cm.

PLATE XXXIV.

Fig. 1. *Porites astreoides* Lam., forma *α*. Calices enlarged.

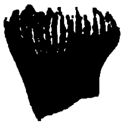
Fig. 2. *Porites astreoides* Lam., forma *β*. Calices enlarged.

PLATE XXXV: *Millepora alcicornis* Linn. Digitiform variety; greatest breadth, 35.5 cm.

PLATE XXXVI: *Millepora alcicornis* Linn. Variety with flabellate fronds; height of specimen, 28.5 cm

PLATE XXXVII: *Millepora alcicornis* Linn. A small digitiform corallum; height, 19 cm.

PLATE XXXVIII: *Millepora alcicornis* Linn. A portion of the surface of the specimen represented by pl. XXXVII, enlarged.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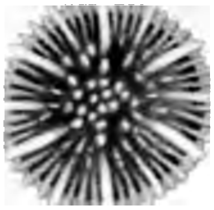
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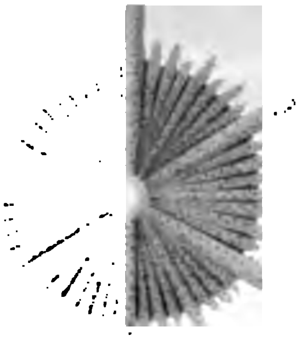
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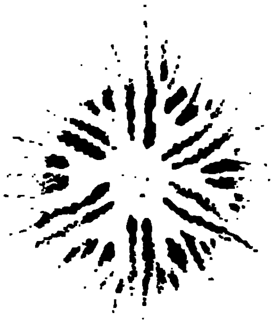
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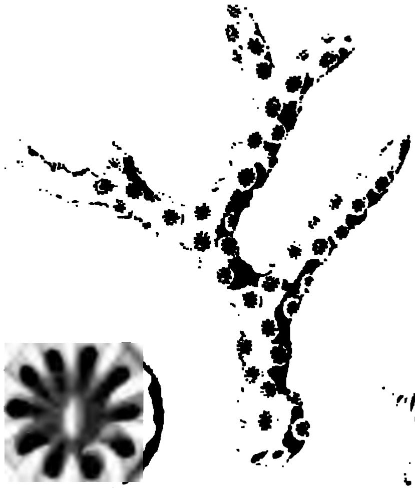
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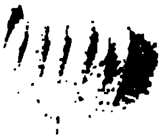
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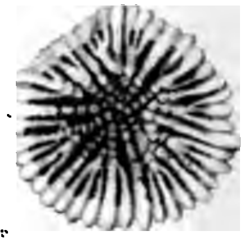
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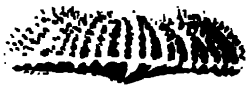
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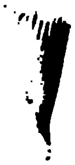
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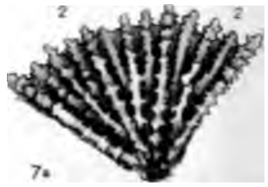

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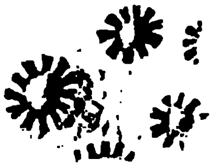
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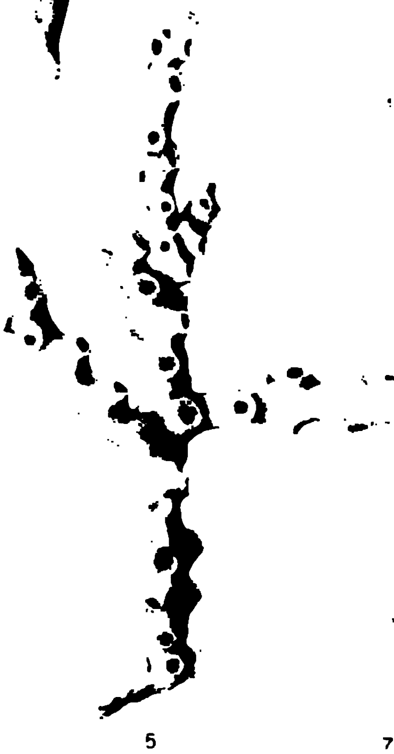
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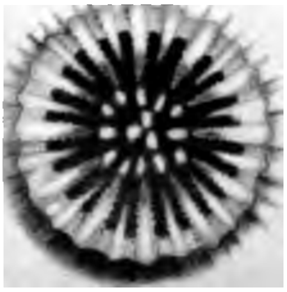
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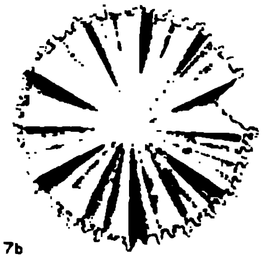
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PARACYATHUS, DELTOCYATHUS, AXHELIA, OCULINA, ASTRANGIA, "DIASERIS."

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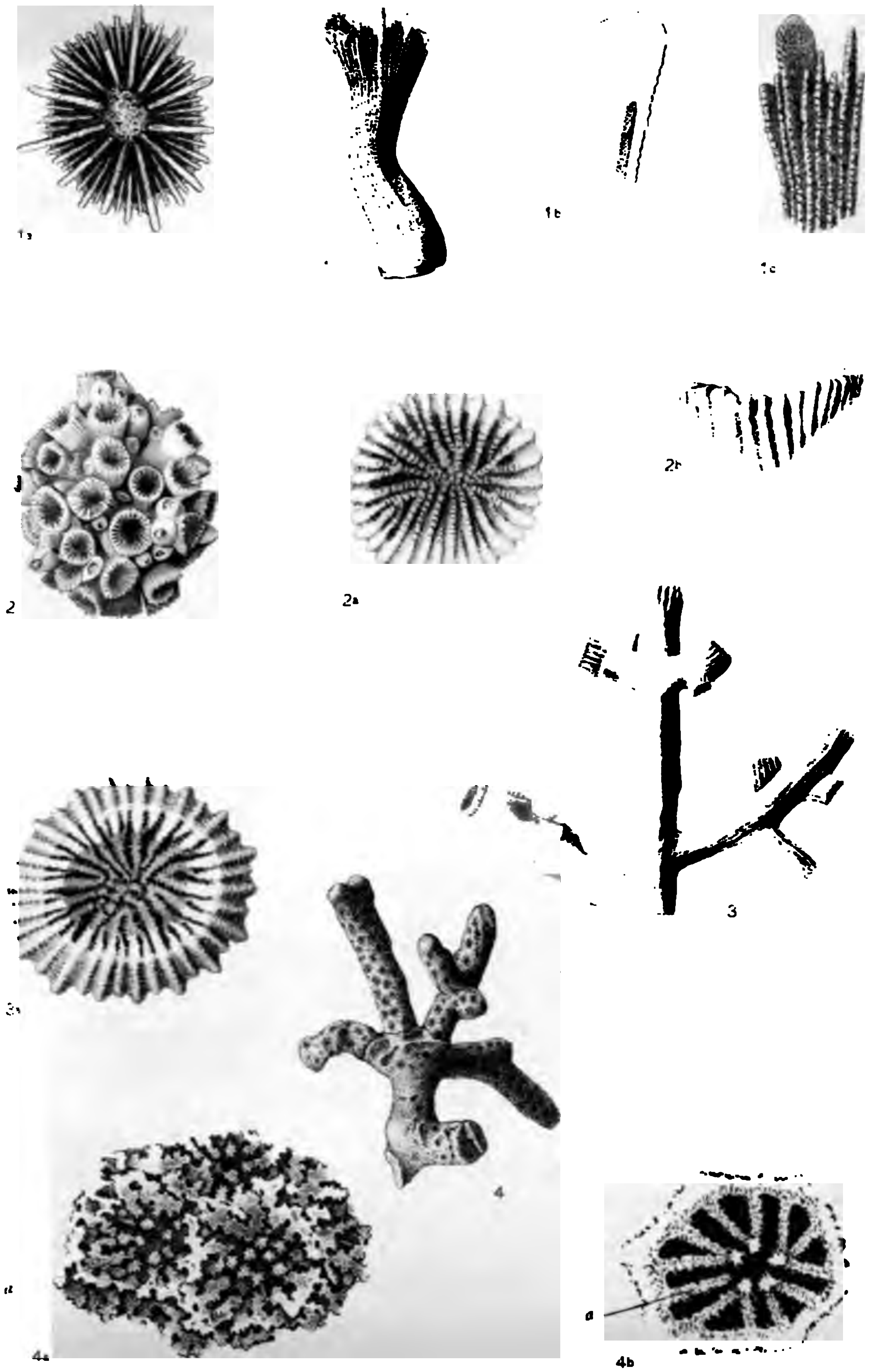
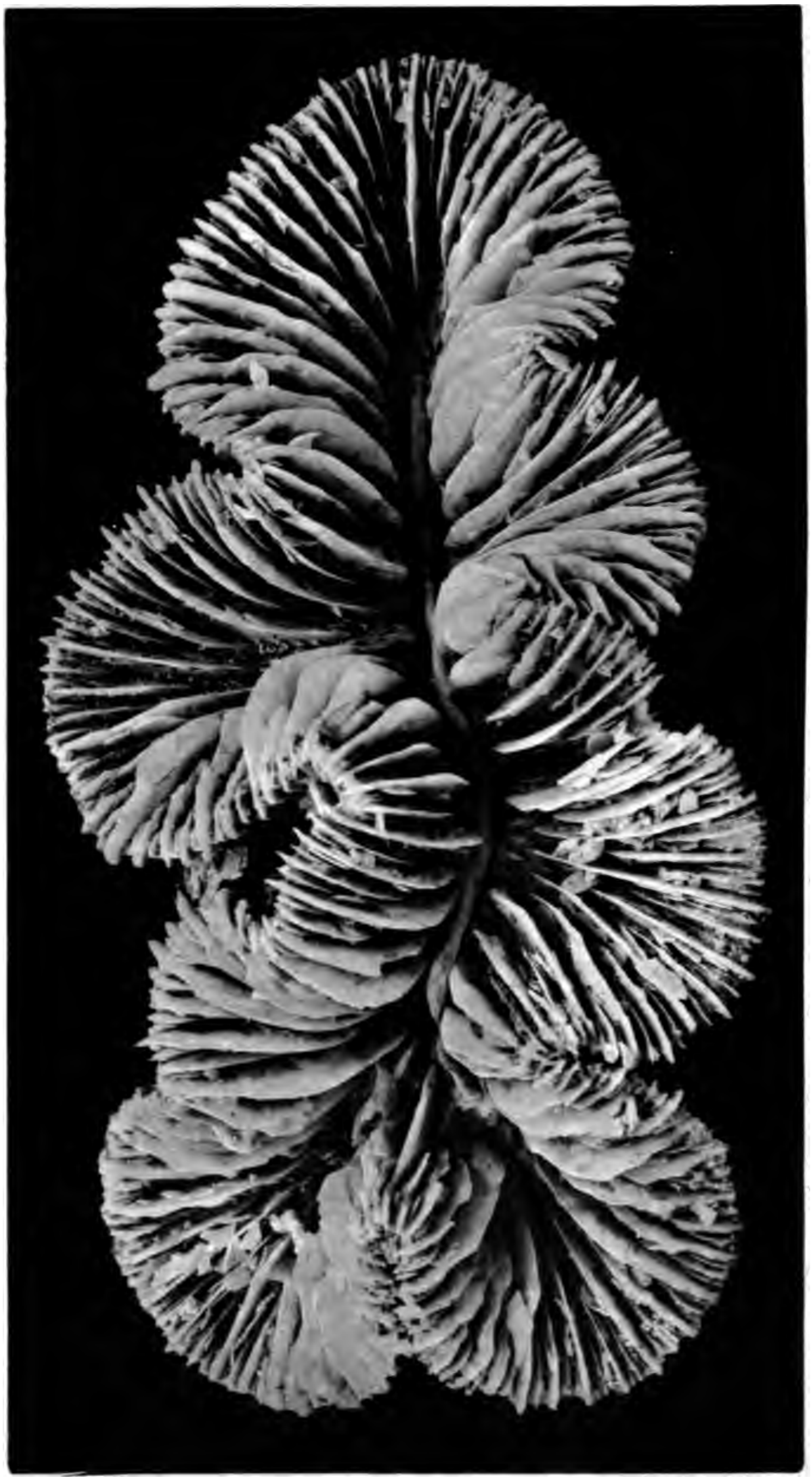
PLATE II.



CYATHOCERAS, ASTRANGIA, CLADOCORA, PORITES.

HELIOTYPE PRINTING CO. BOSTON



MEANDRINA MAEANDRITES (LINN.) ? YOUNG. VIEW FROM ABOVE, GREATEST LENGTH, 79 MM.

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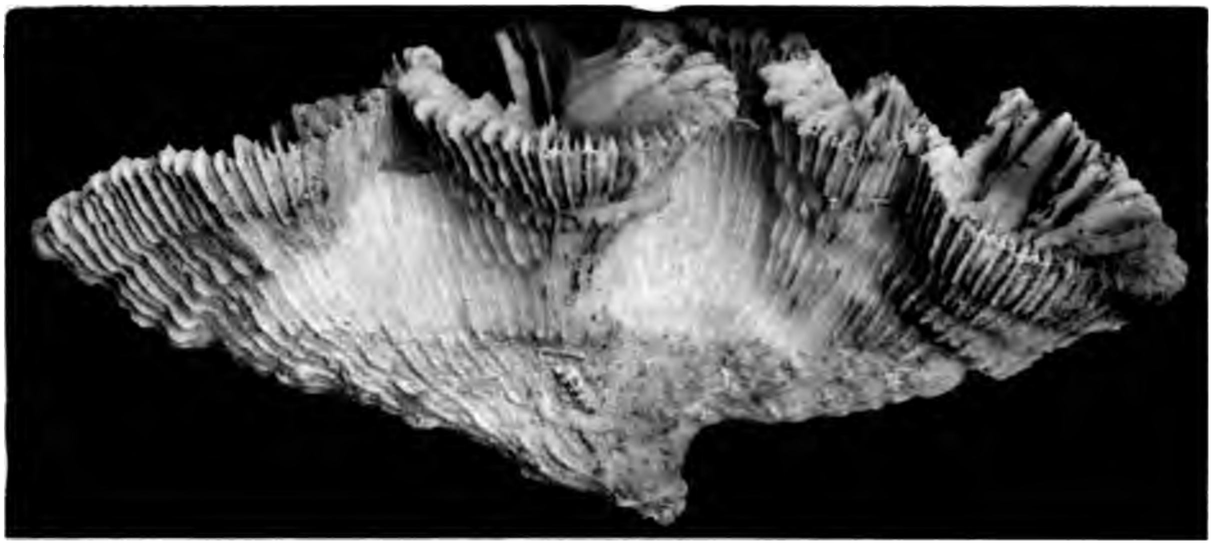
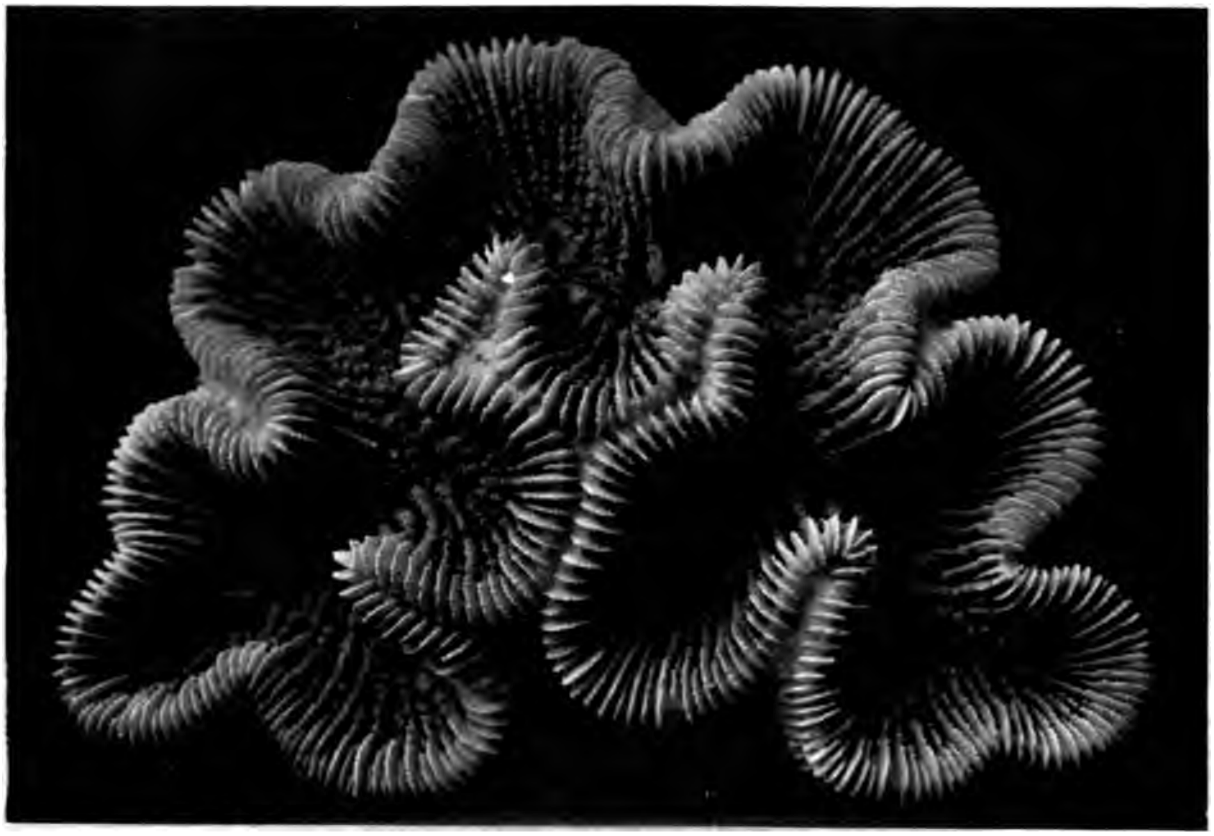
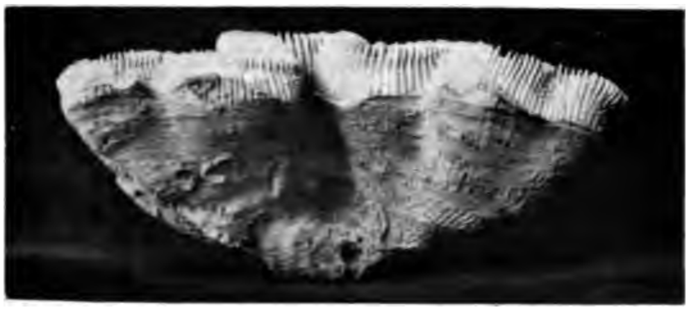


FIG. 1. MEANDRINA MAEANDRITES (LINN.); YOUNG. UPRIGHT VIEW OF CORALLUM, GREATEST LENGTH, 79 MM.





FIGS. 2, 3. MANICINA AREOLATA (LINN.). FIG. 2, CALICULAR VIEW; FIG. 3, UPRIGHT VIEW, GREATEST TRANSVERSE MEASUREMENT, 57 MM.

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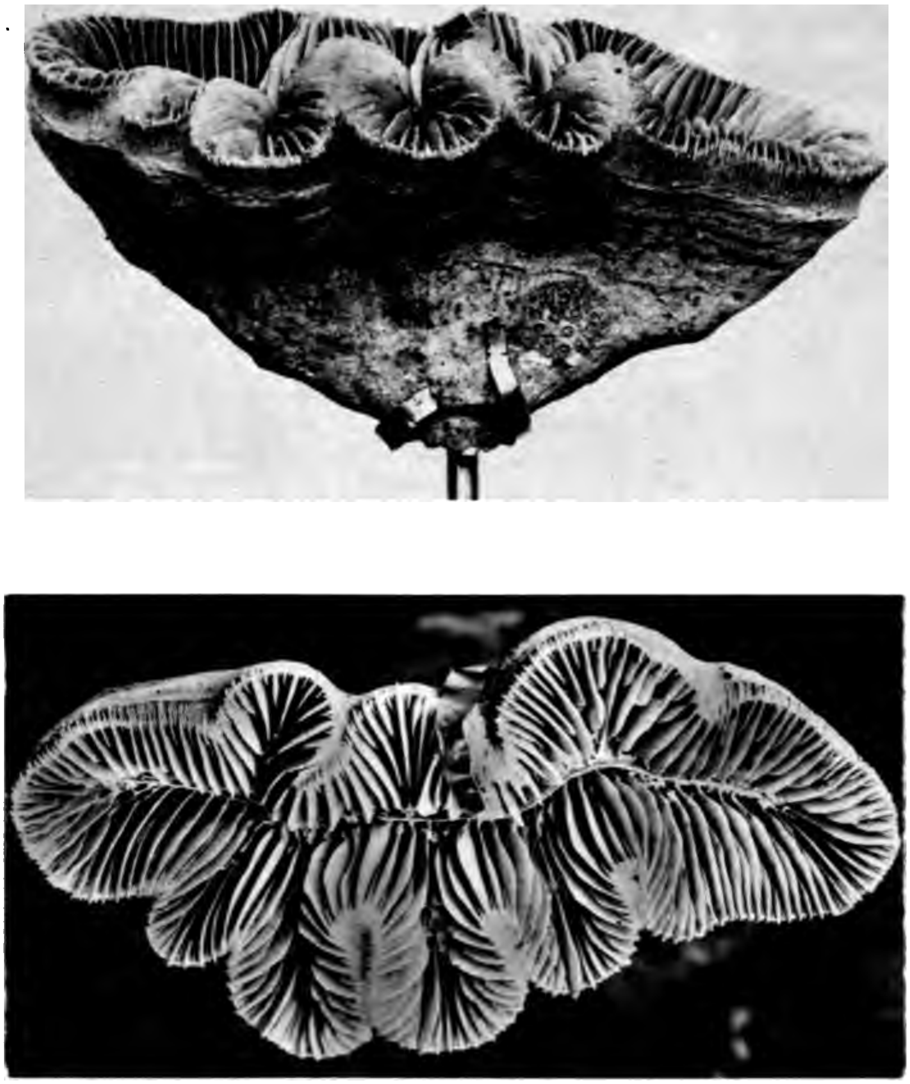
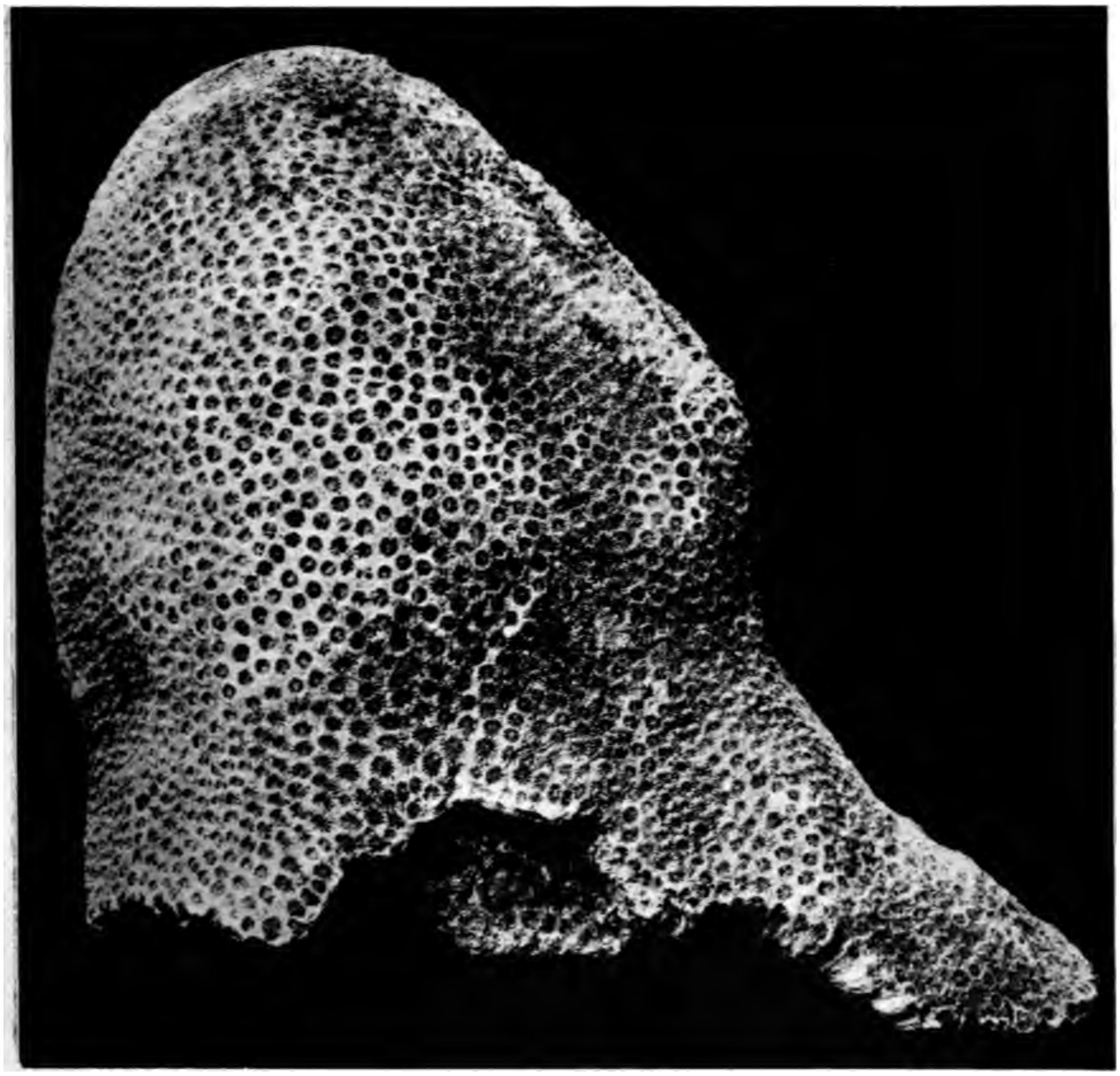


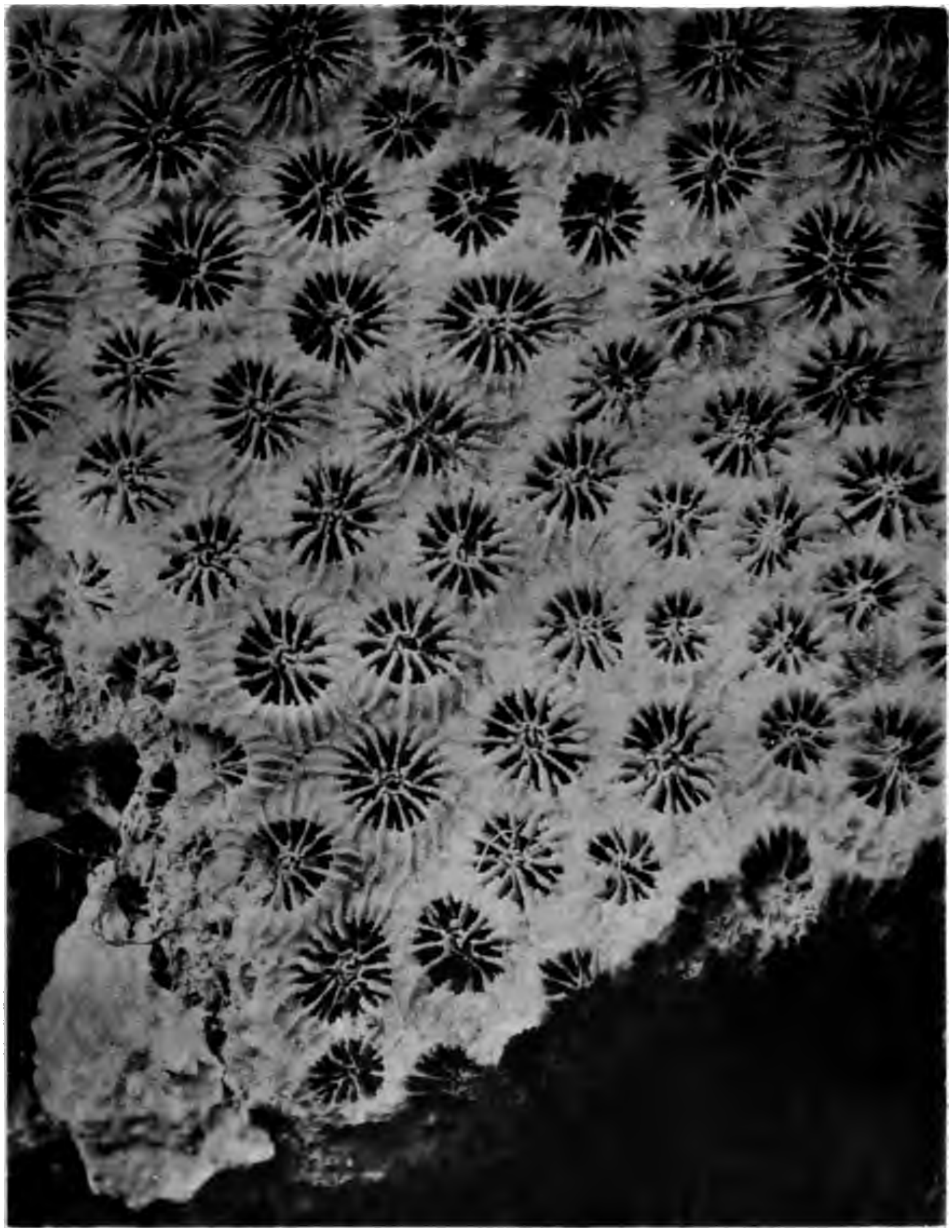
MEANDRINA DANAE (M. -EDW. & H.). FIGURES FROM PHOTOGRAPHS OF TYPES IN THE MUSEUM D'HISTOIRE NATURELLE, PARIS.

HELIOTYPE PRINTING CO. BOSTON



ORBICELLA ACROPORA (LINN.) VAR. GENERAL VIEW OF A CORALLUM 18.7 CM. HIGH.

HELIOTYPE PRINTING CO., BOSTON.



ORBICELLA ACROPORA (LINN.) VAR. CALICES ENLARGED, USUAL DIAMETER OF CALICES ABOUT 4.5 MM., ENLARGEMENT ABOUT FIVE TIMES.

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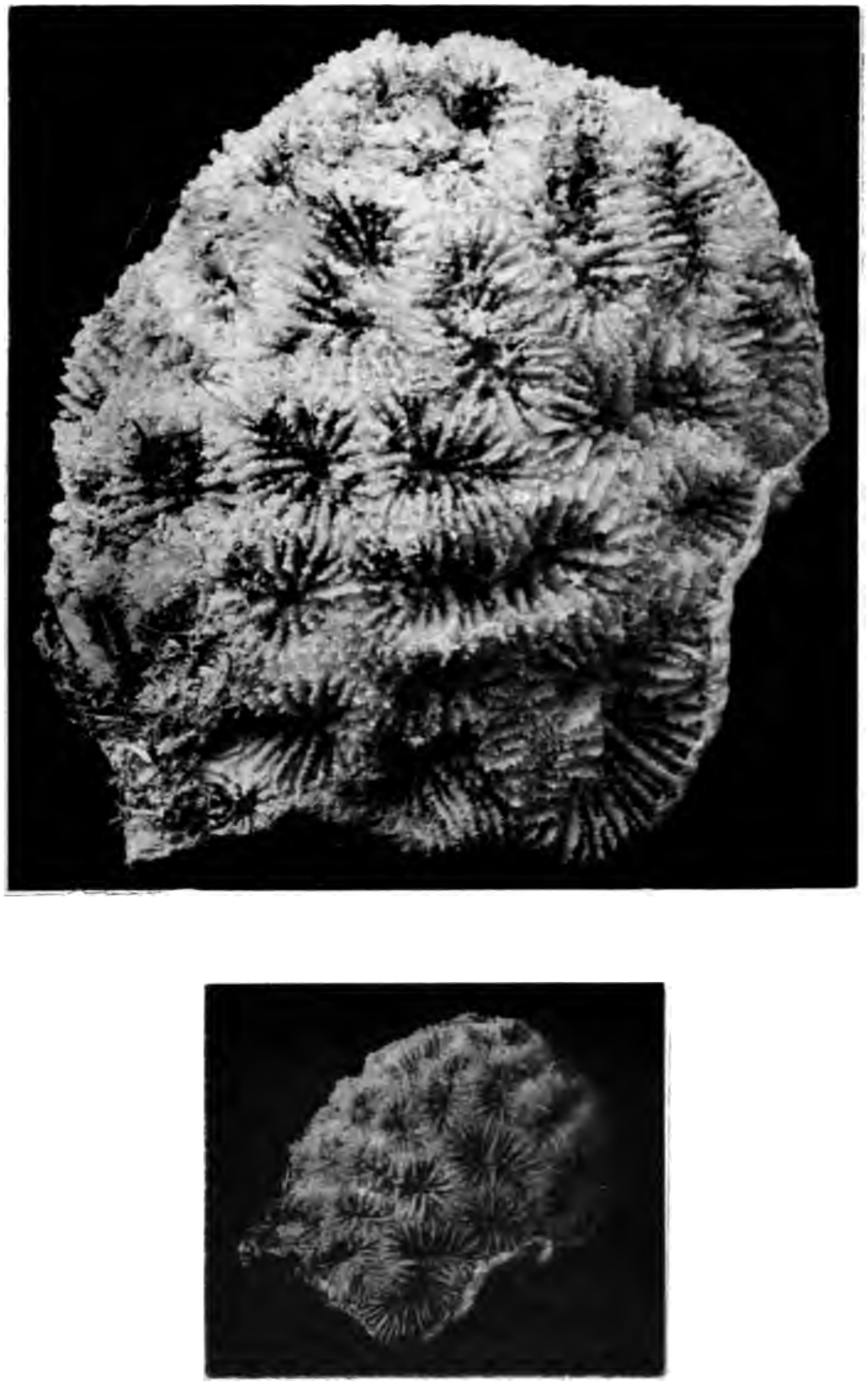
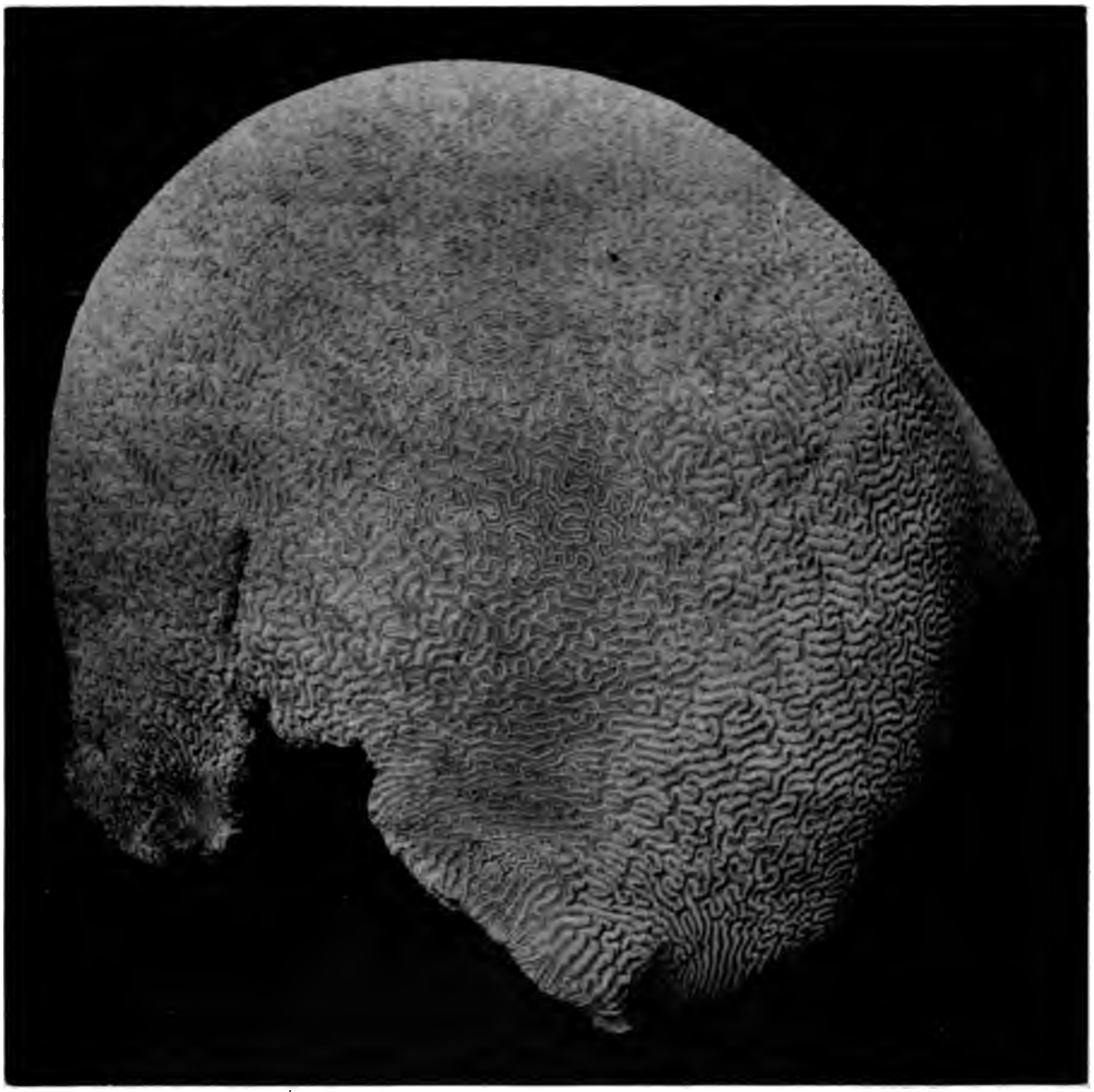


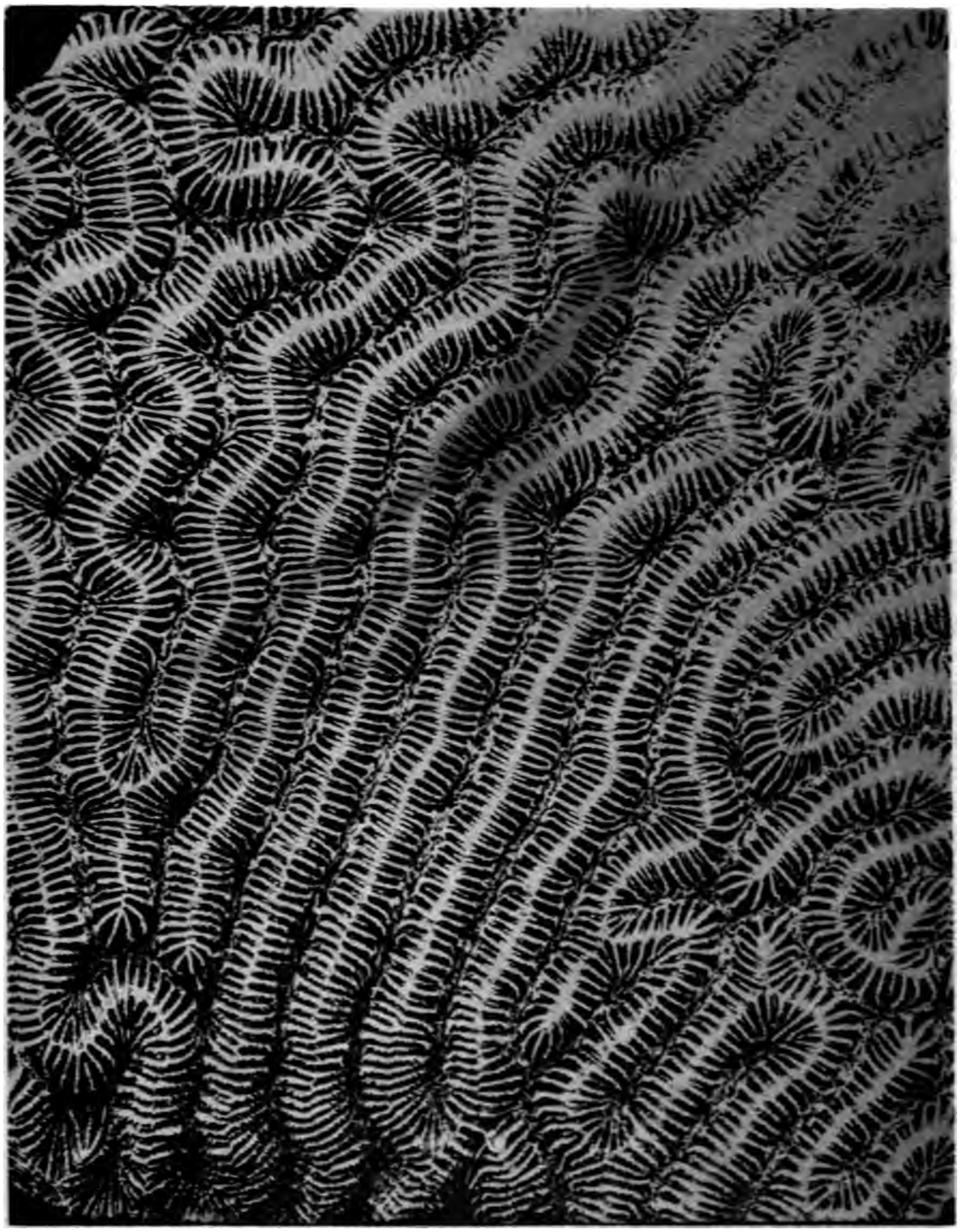
FAVIA FRAGUM (ESPER). LOWER FIGURE, VIEW OF A CORALLUM FROM SIDE. UPPER FIGURE, VIEW FROM ABOVE, MORE ENLARGED. GREATER TRANSVERSE DIAMETER OF SPECIMEN, 2.85 CM.

HELIOTYPE PRINTING CO. BOSTON



PLATYGYRA VIRIDIS (LE SUEUR). GENERAL VIEW OF A LARGE HEAD, HEIGHT, 35 CM.

HELIOTYPE CO., BOSTON.



PLATYGYRA VIRIDIS (LESUEUR). VALLEYS ENLARGED.

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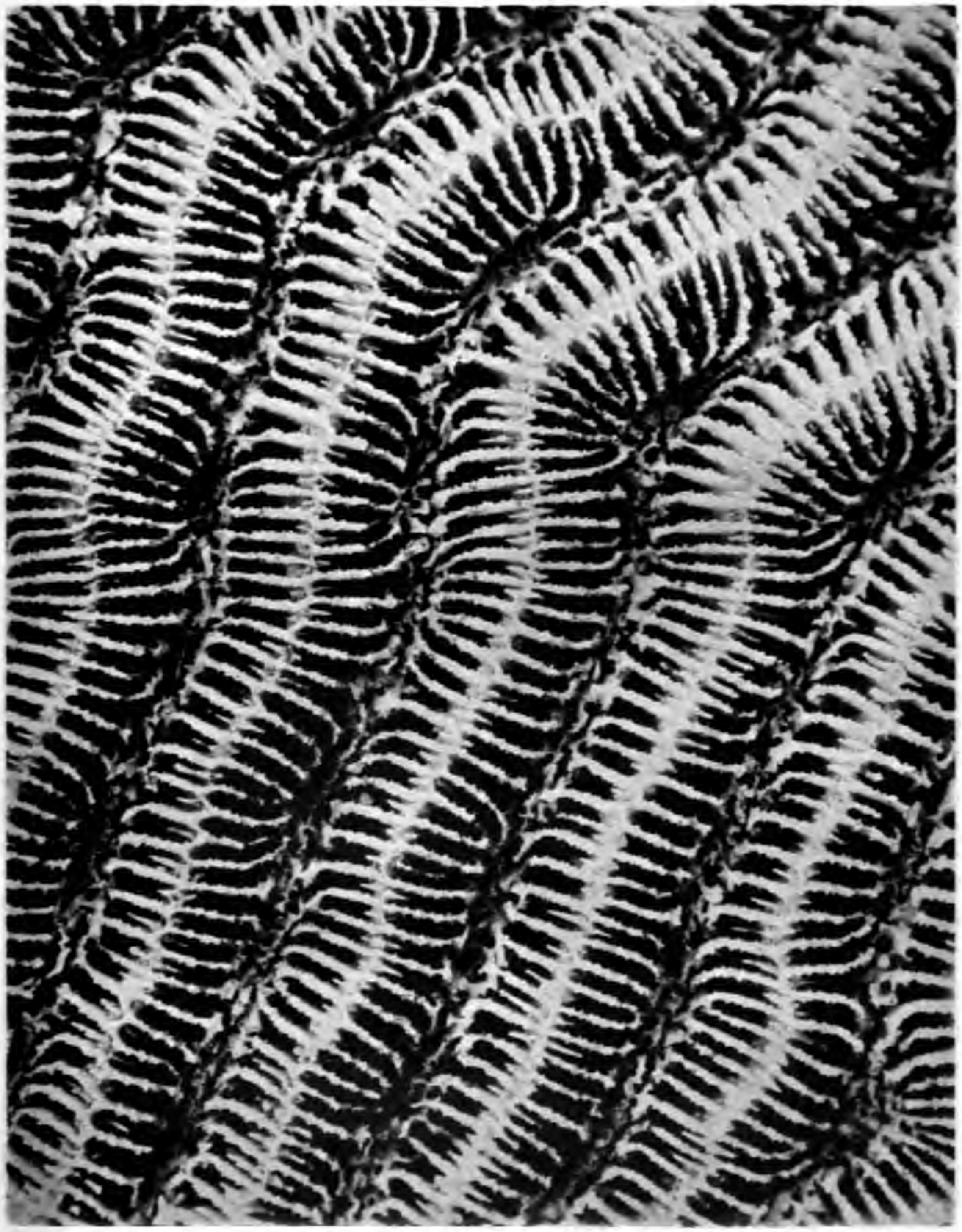
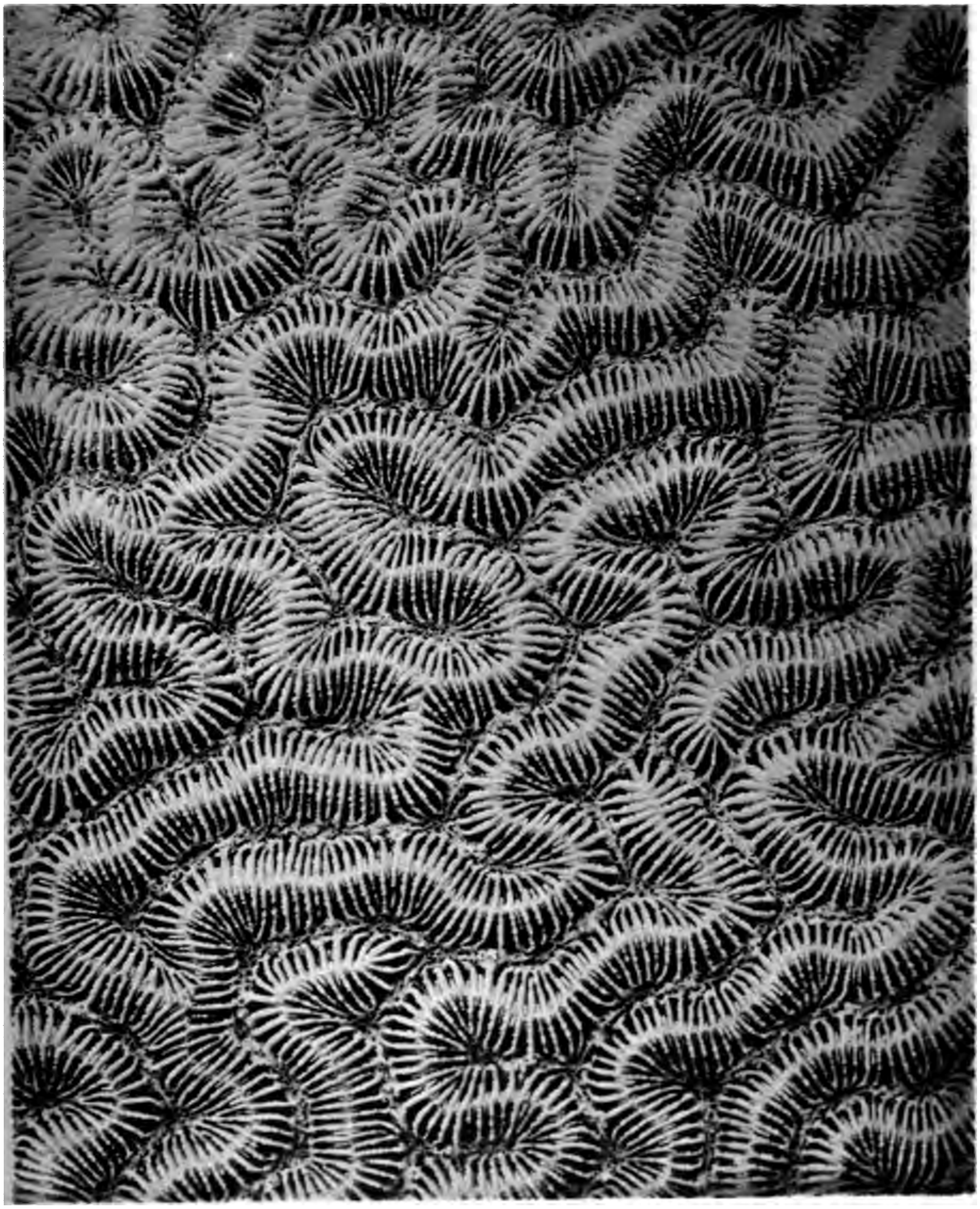


PLATYGYRA VIRIDIS (LESUEUR). PORTION OF VALLEYS REPRESENTED BY PLATE X, MORE HIGHLY ENLARGED.

HELIOTYPE PRINTING CO. BOSTON.



PLATYGYRA VIRIDIS (LESUEUR). MEANDRIFORM VALLEYS ENLARGED.

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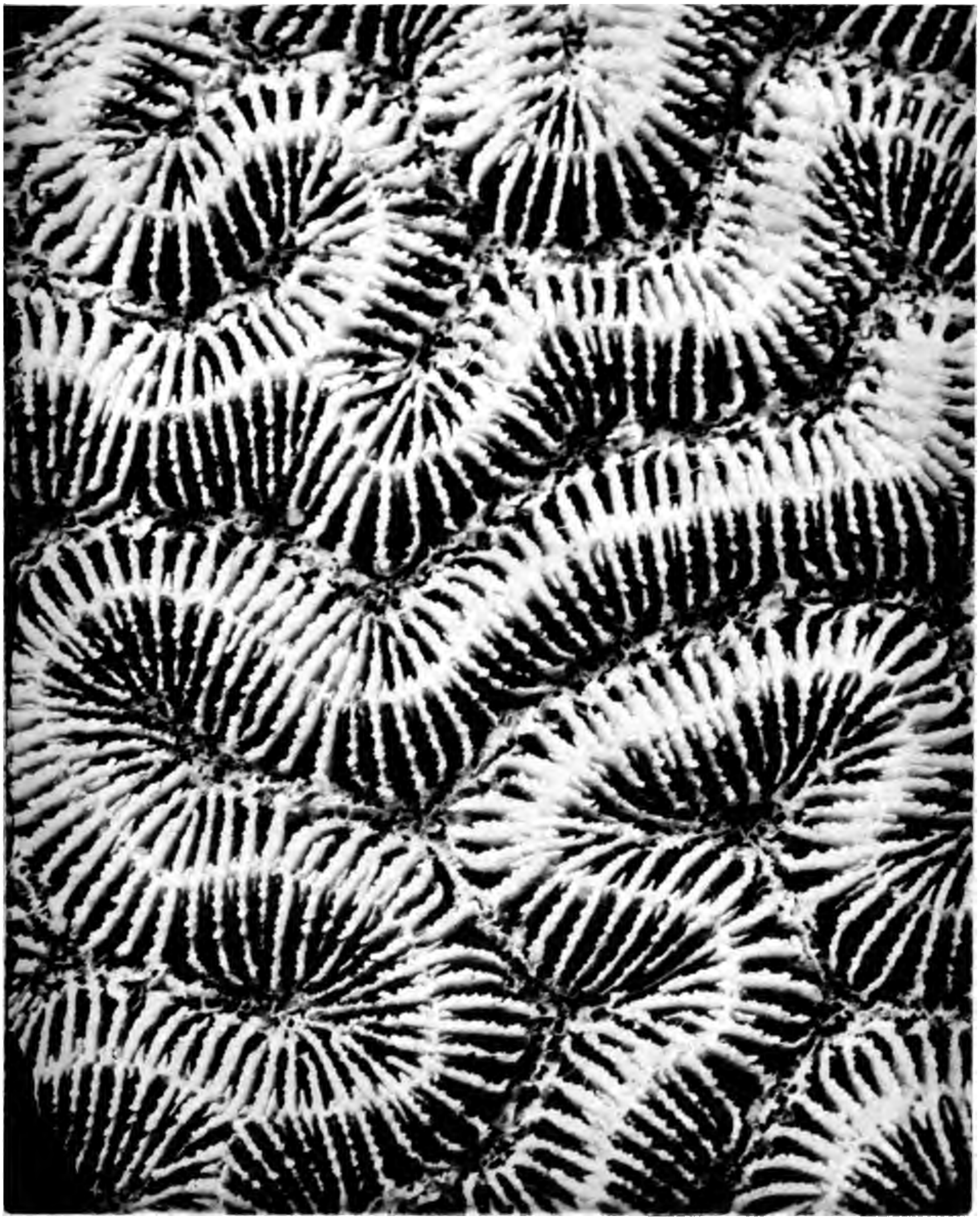

PLATYGYRA VIRIDIS (LESUEUR). PORTION OF VALLEYS REPRESENTED BY PLATE XII, MORE HIGHLY MAGNIFIED.

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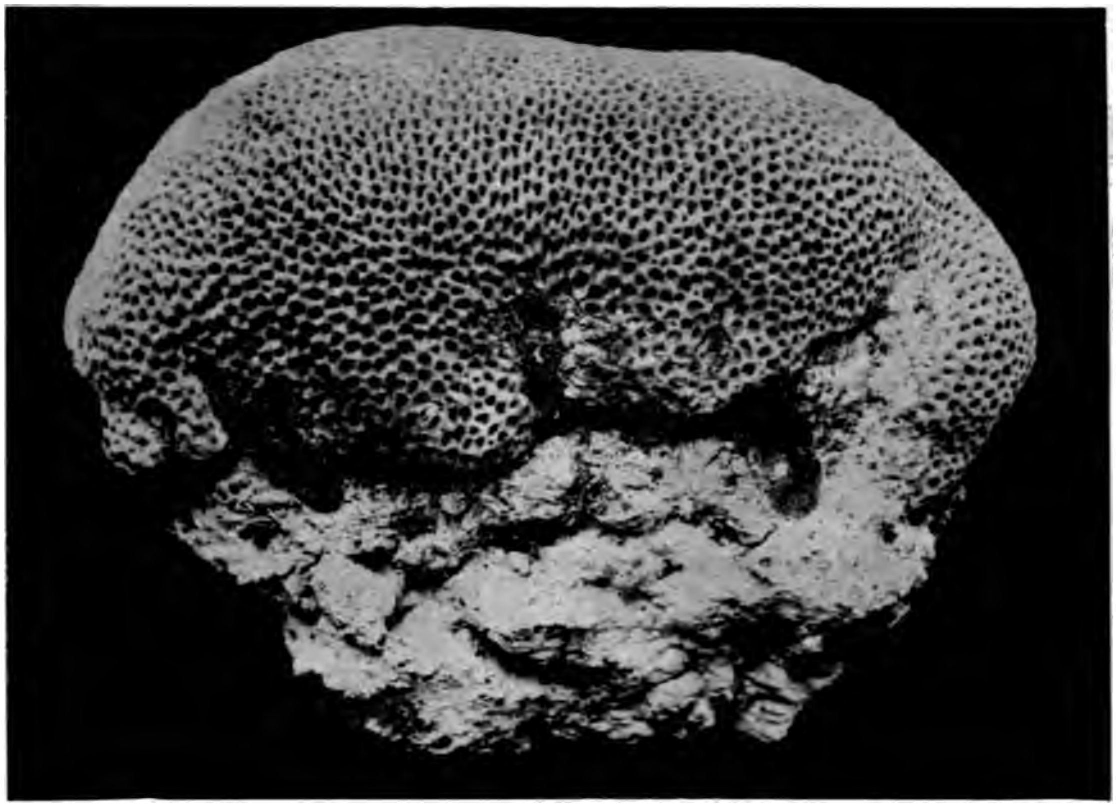

FIG. 1. SIDERASTREA [illegible] (ELL. & SOL.). [illegible] SPECIMEN
[illegible]

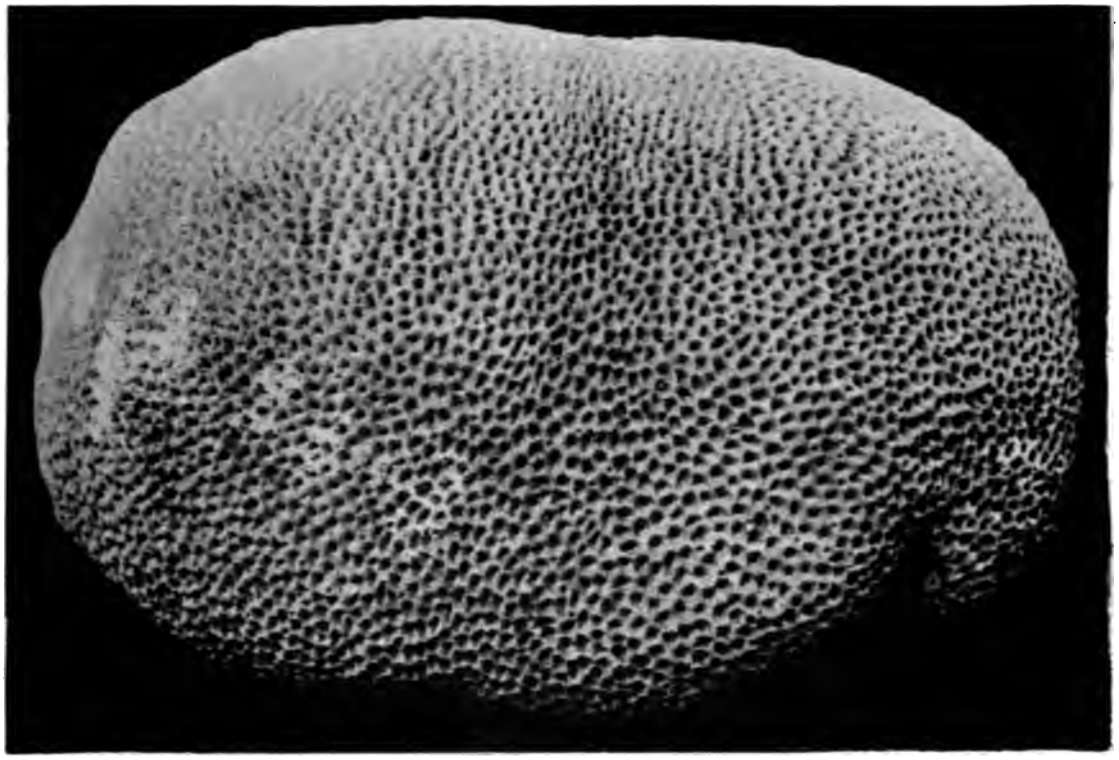

FIG. 2. SIDERASTREA SIDEREA (ELL. & SOL.). VIEW OF SAME SPECIMEN FROM ABOVE.

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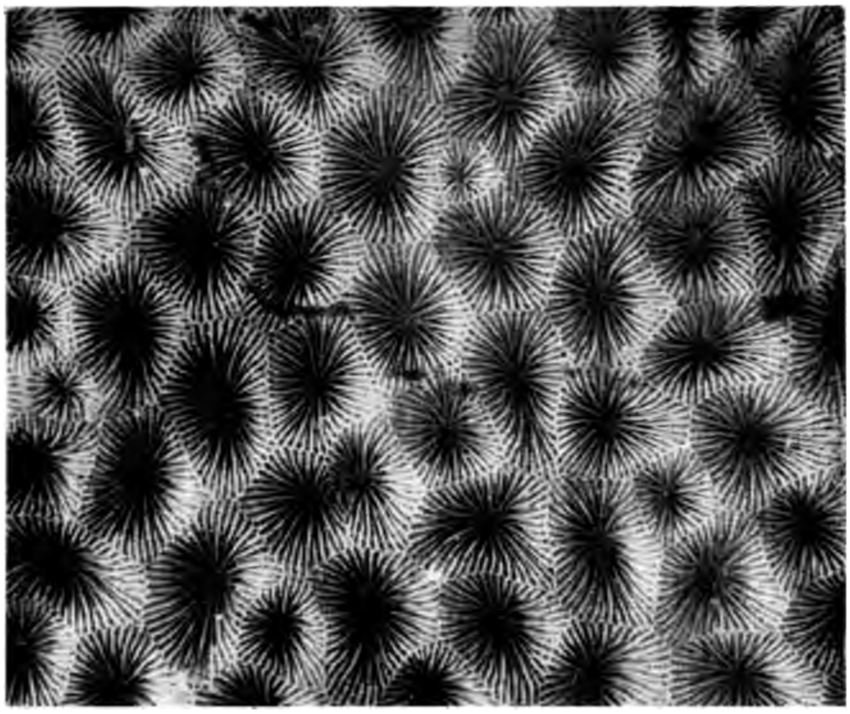
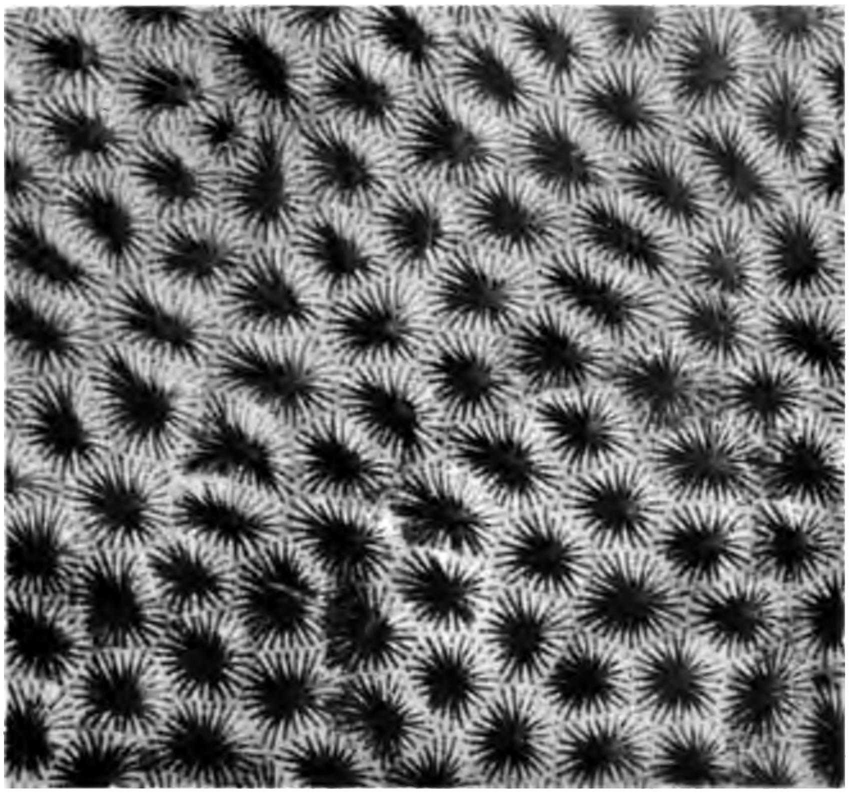


1. SIDERASTREA SIDEREA (ELL. & SOL.). CALICES ENLARGED.



2. SIDERASTREA RADIANS (PALLAS). CALICES ENLARGED.

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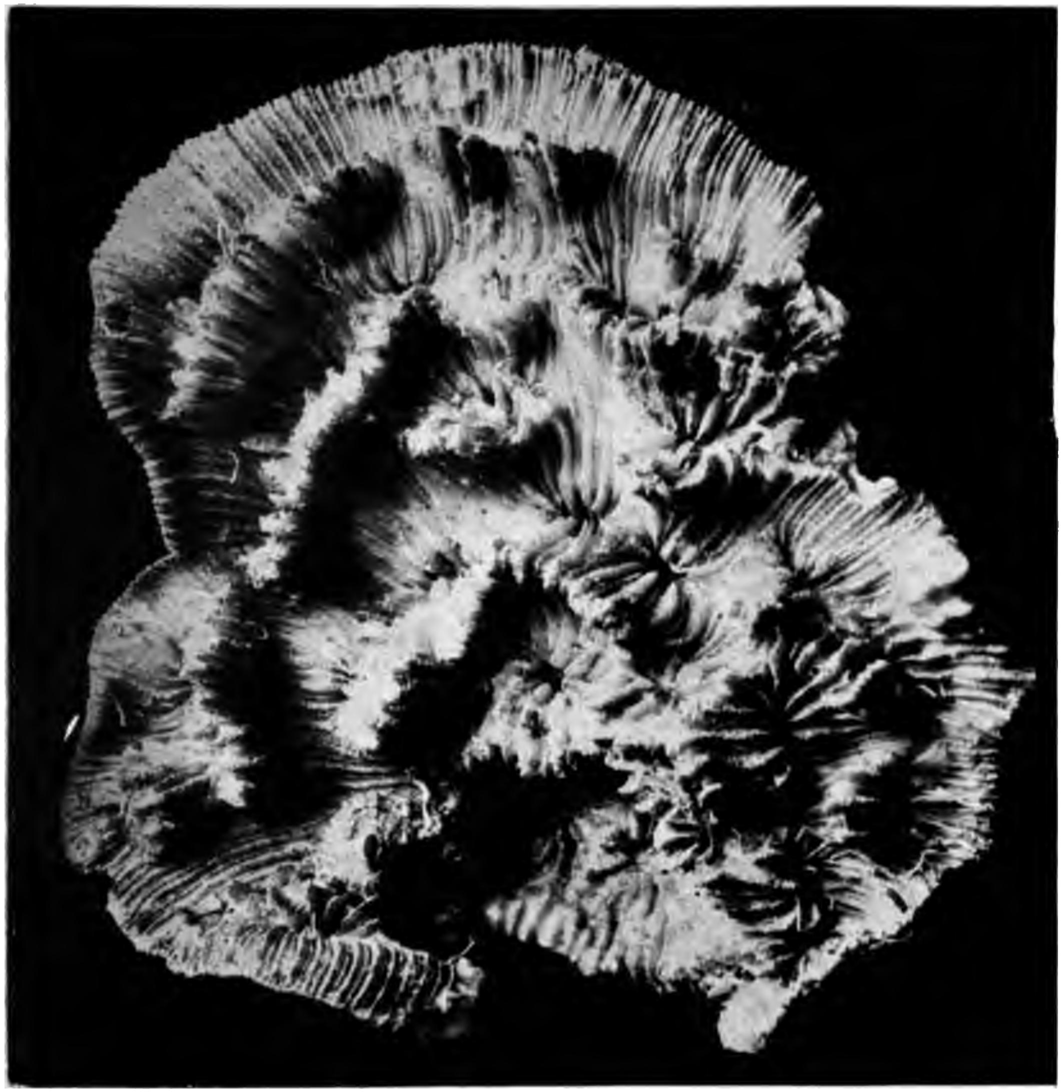


FIG. 1. AGARICIA ELEPHANTOTUS (PALLAS). VIEW OF A CORALLUM FROM ABOVE, GREATEST WIDTH 36 MM.

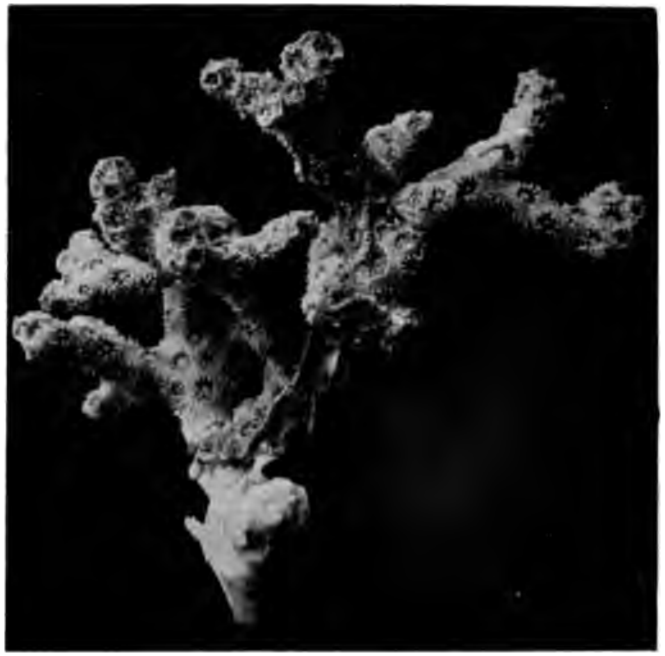
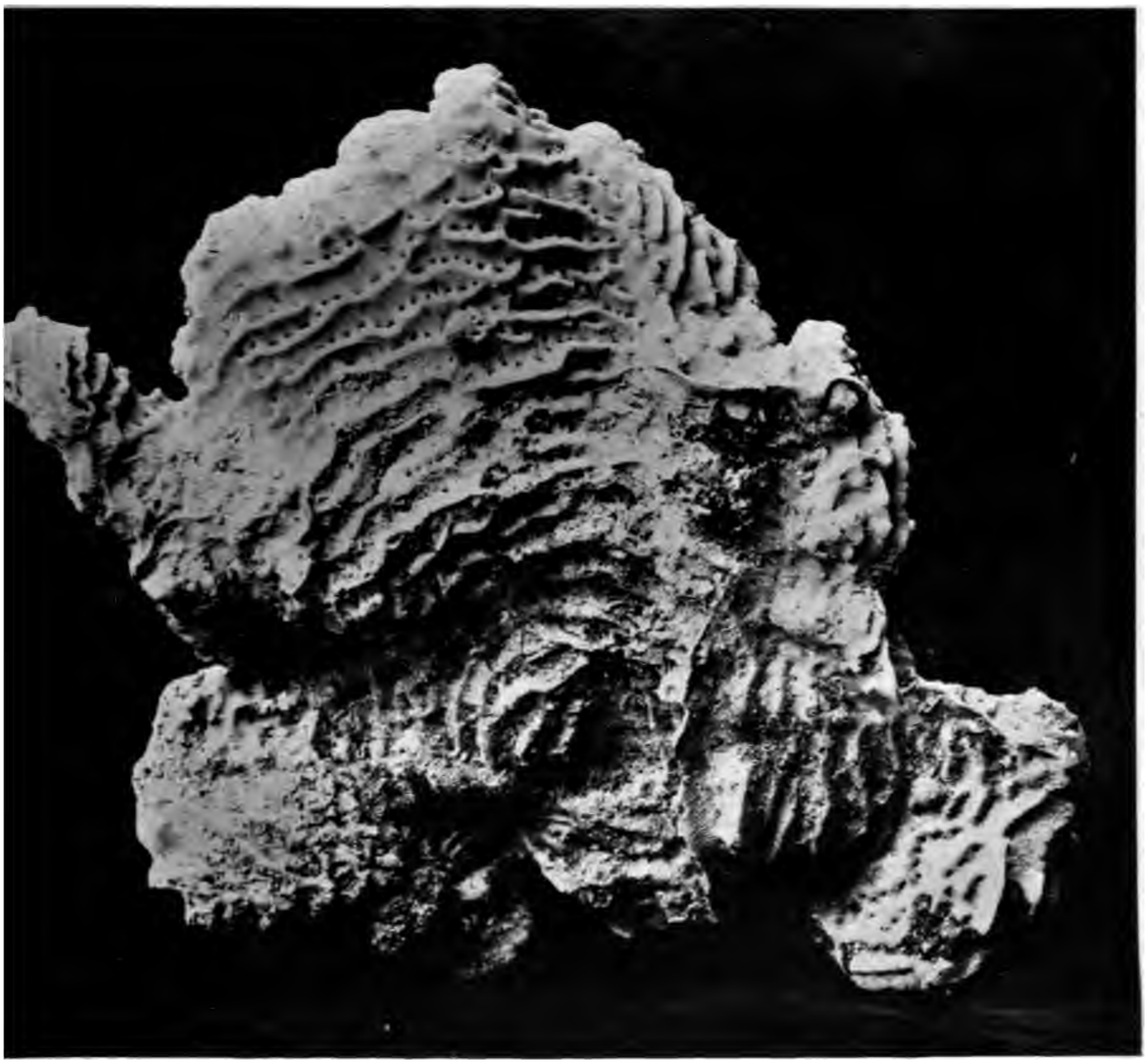


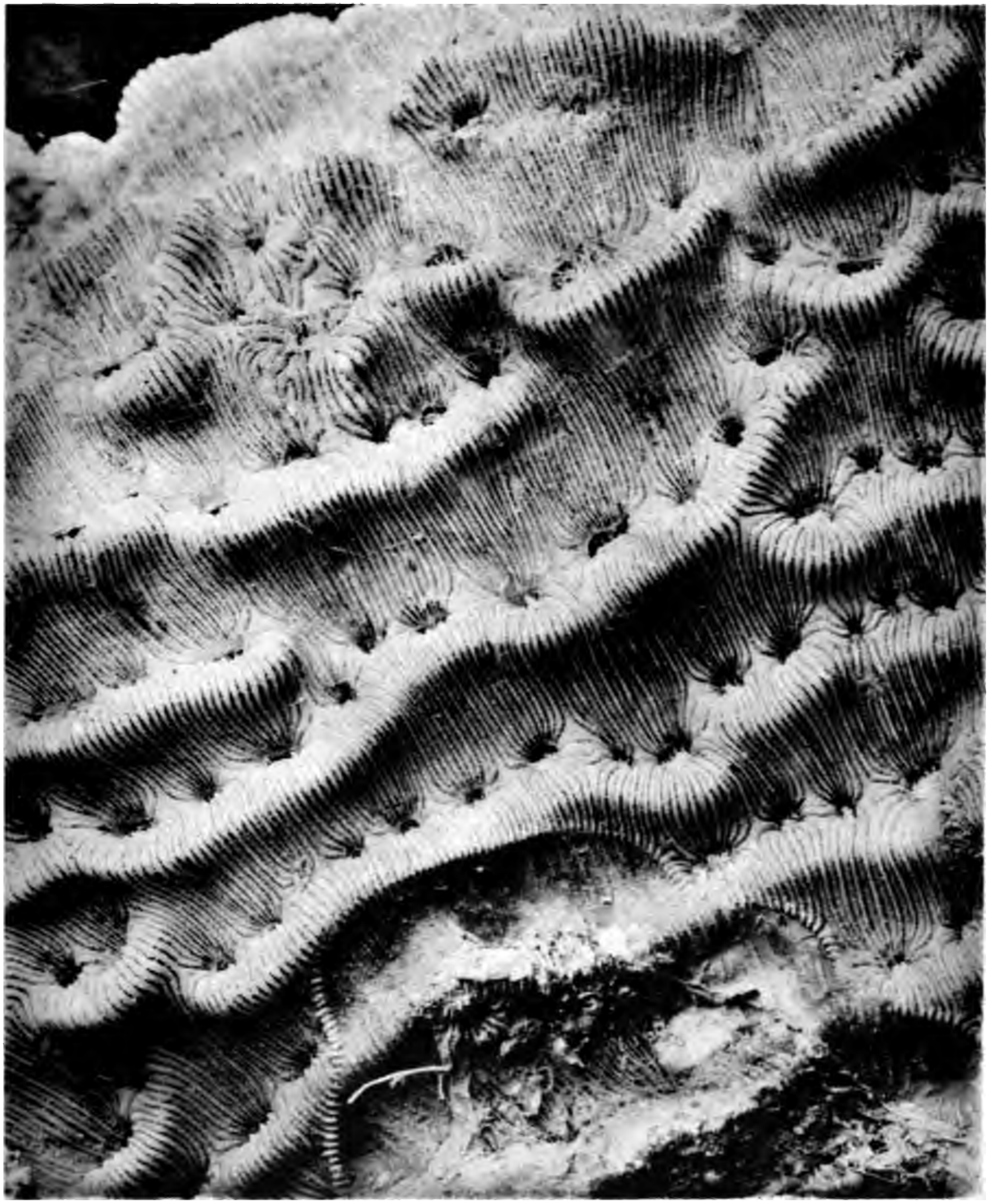
FIG. 2. AXHELIA ASPERULA (M.-EDW. & H.). GENERAL VIEW OF A SPECIMEN, HEIGHT 34.5 MM.

HELIOTYPE PRINTING CO. BOSTON



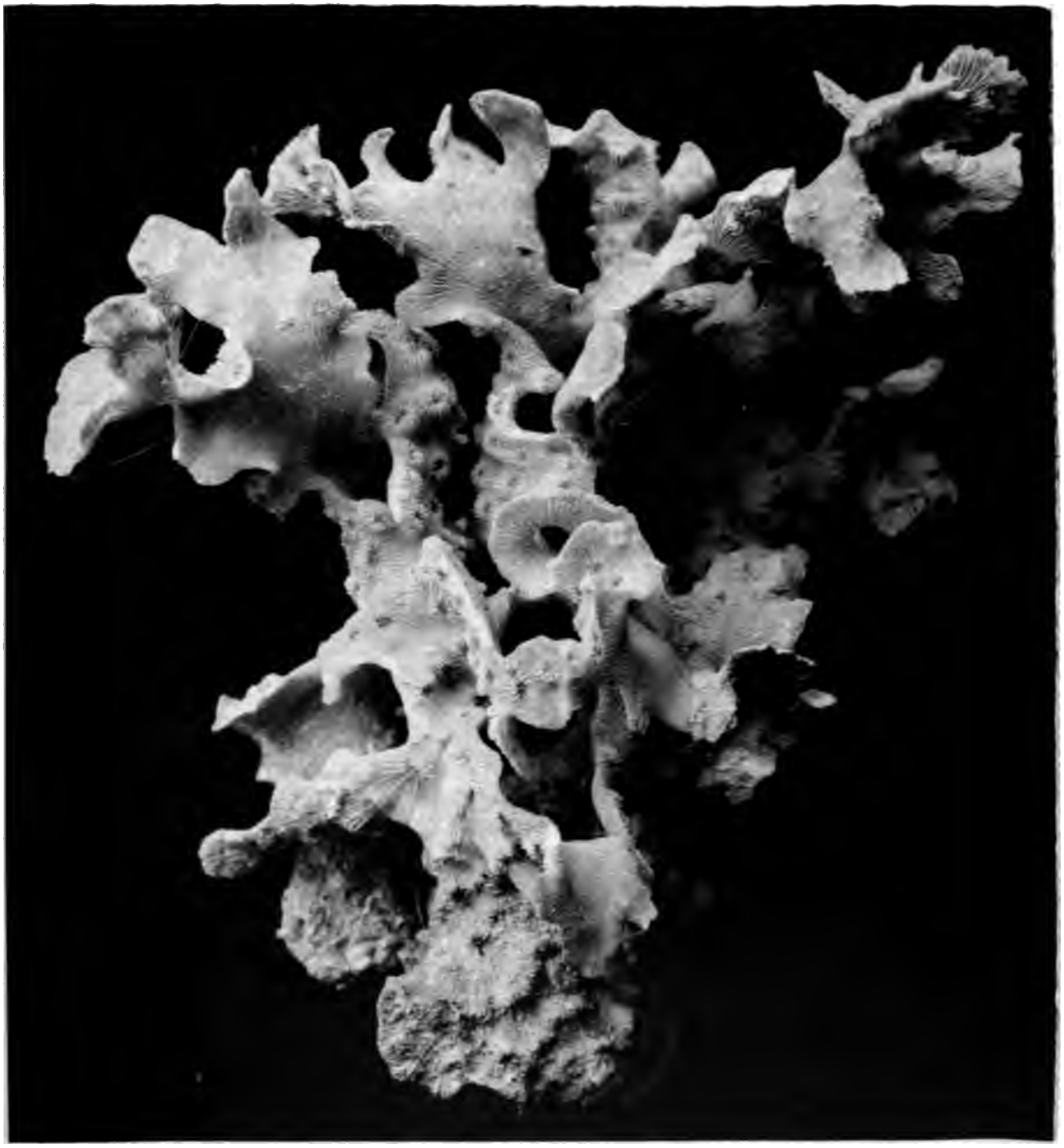
AGARICIA SP. GENERAL VIEW OF A CORALLUM FROM ABOVE. WIDTH BETWEEN EXTREMES OF PROJECTING PORTIONS, 18.8 CM.

HELIOTYPE PRINTING CO. BOSTON



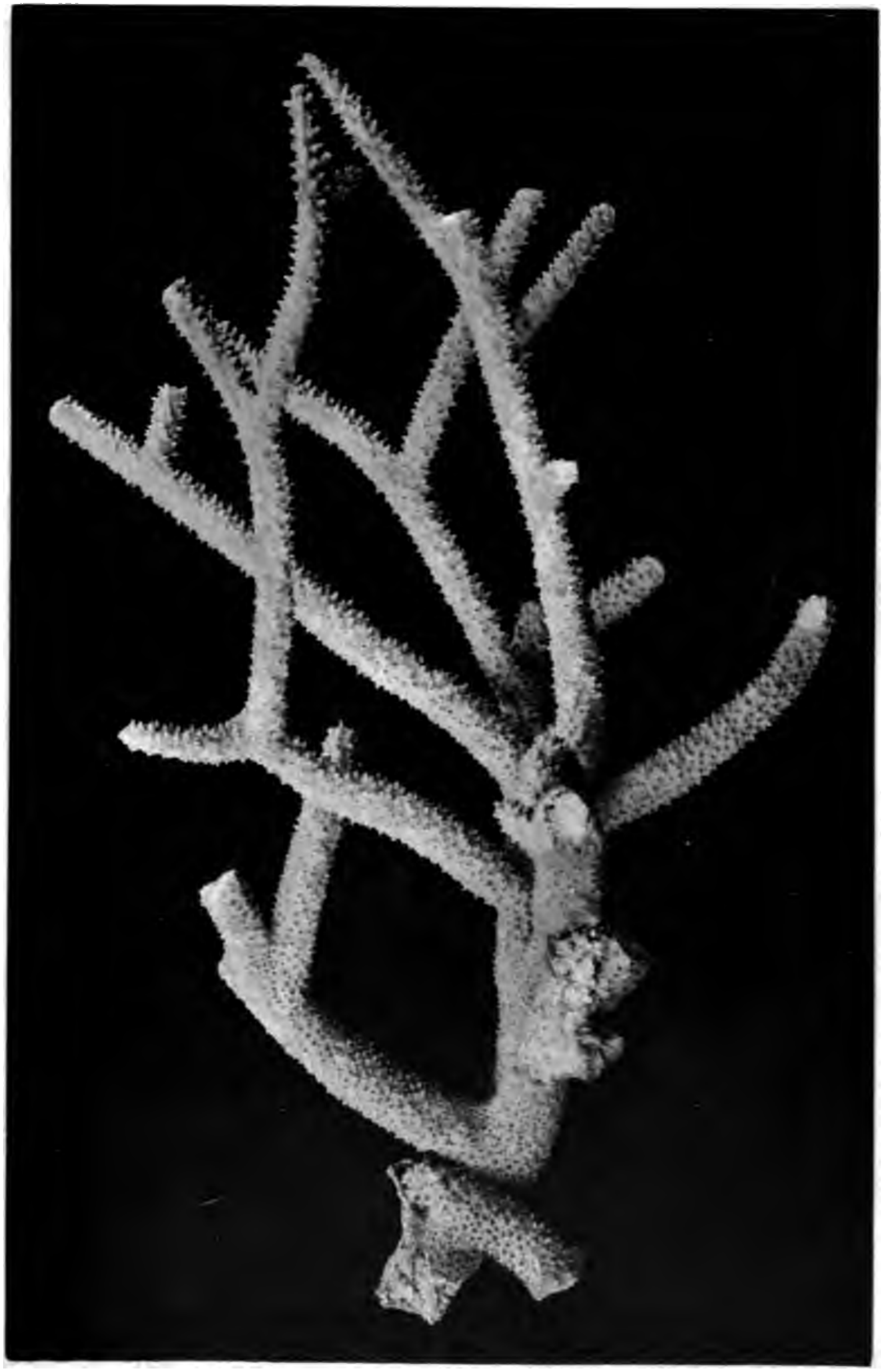
AGARICIA SP., PORTIONS OF VALLEYS, ENLARGED.

HELIOTYPE PRINTING CO. BOSTON.



AGARICIA CAILLETI DUCH. & MICH. GENERAL VIEW OF A CORALLUM, HEIGHT, 17.7 CM.

[illegible]



ISOPORA MURICATA (LINN.) S. S. (=CERVICORNIS LAMARCK). HEIGHT OF SPECIMEN, 37.5 CM.

HELIOTYPE PRINTING CO. BOSTON

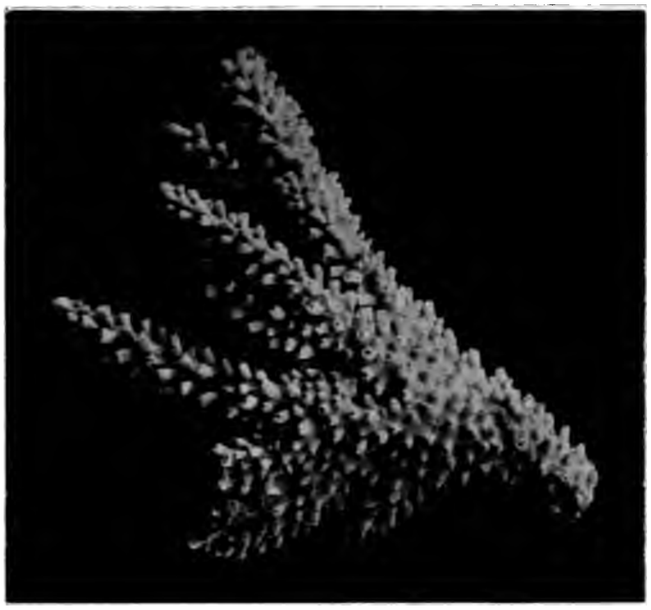


FIG. 1. ISOPORA MURICATA FORMA PROLIFERA LAM. END OF A BRANCH. HEIGHT [illegible] CM.

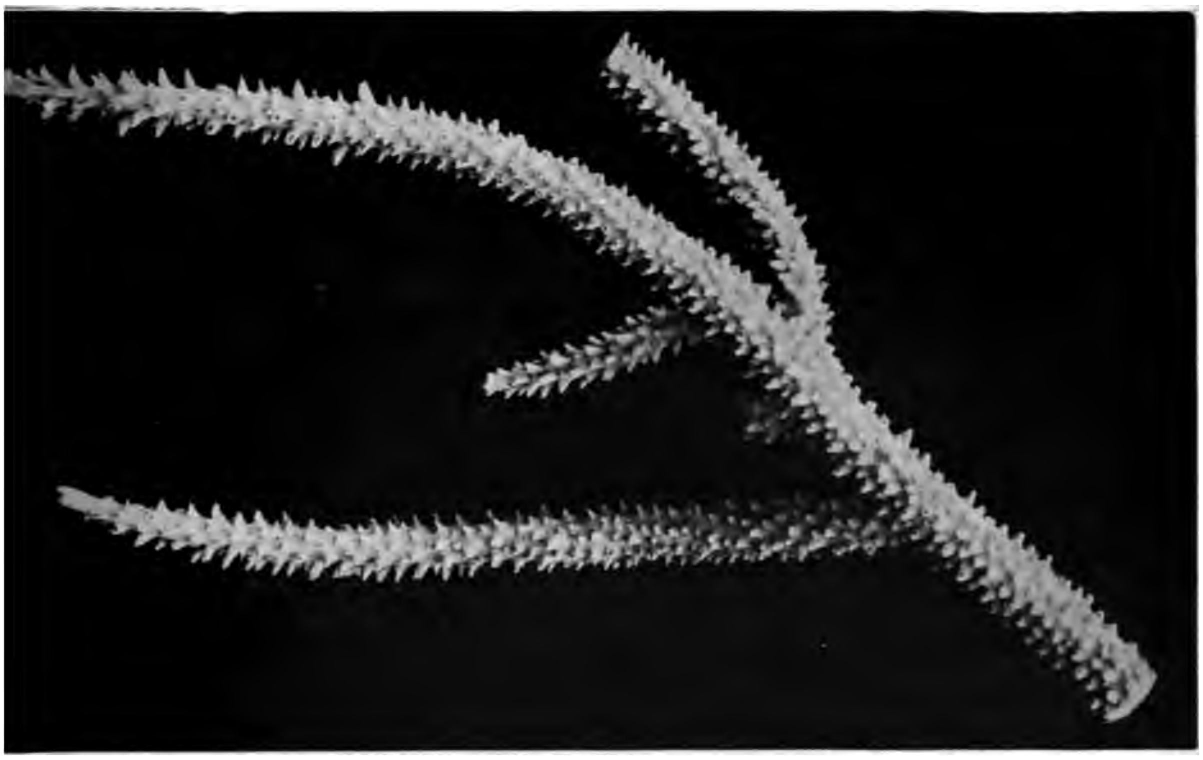
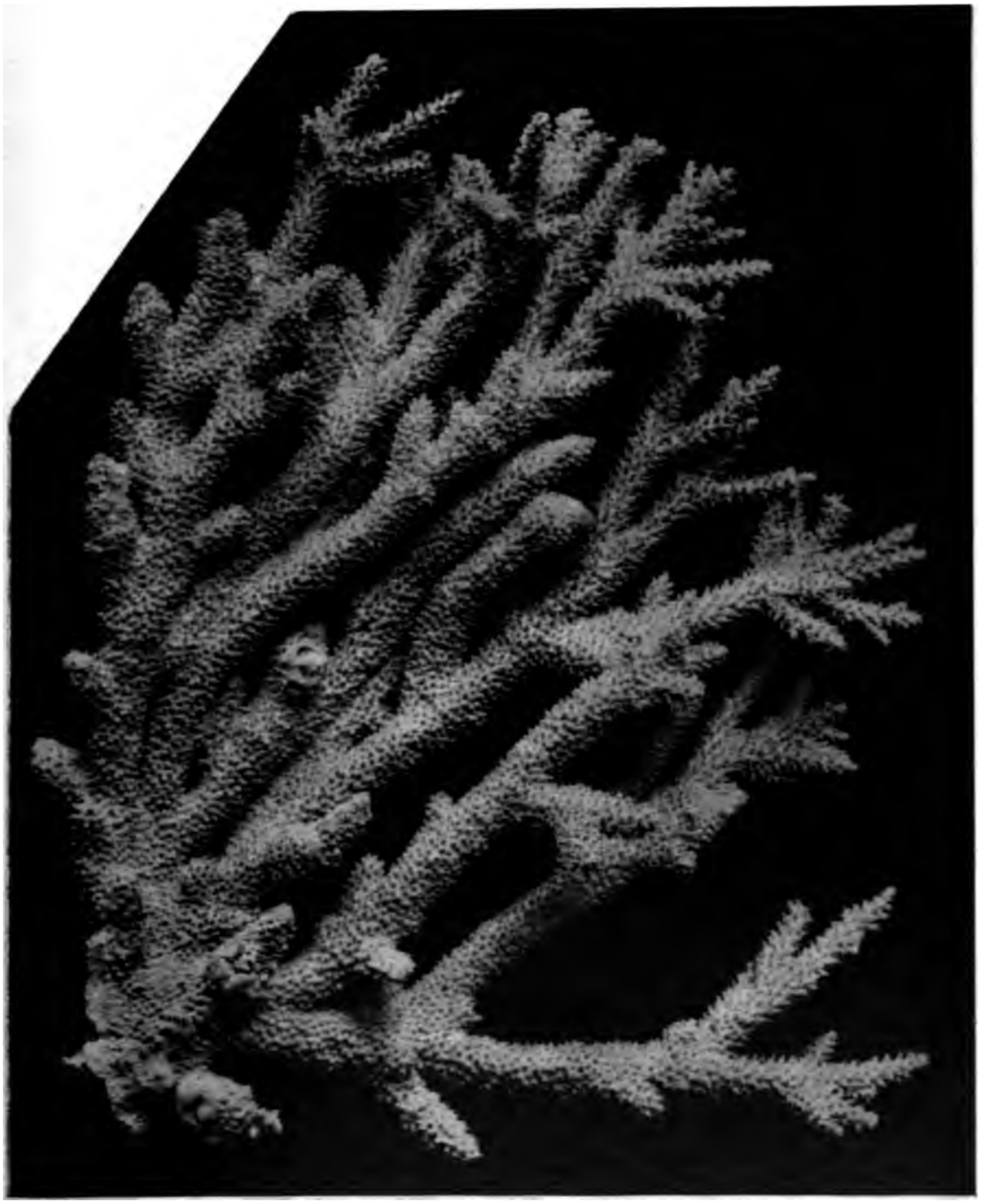
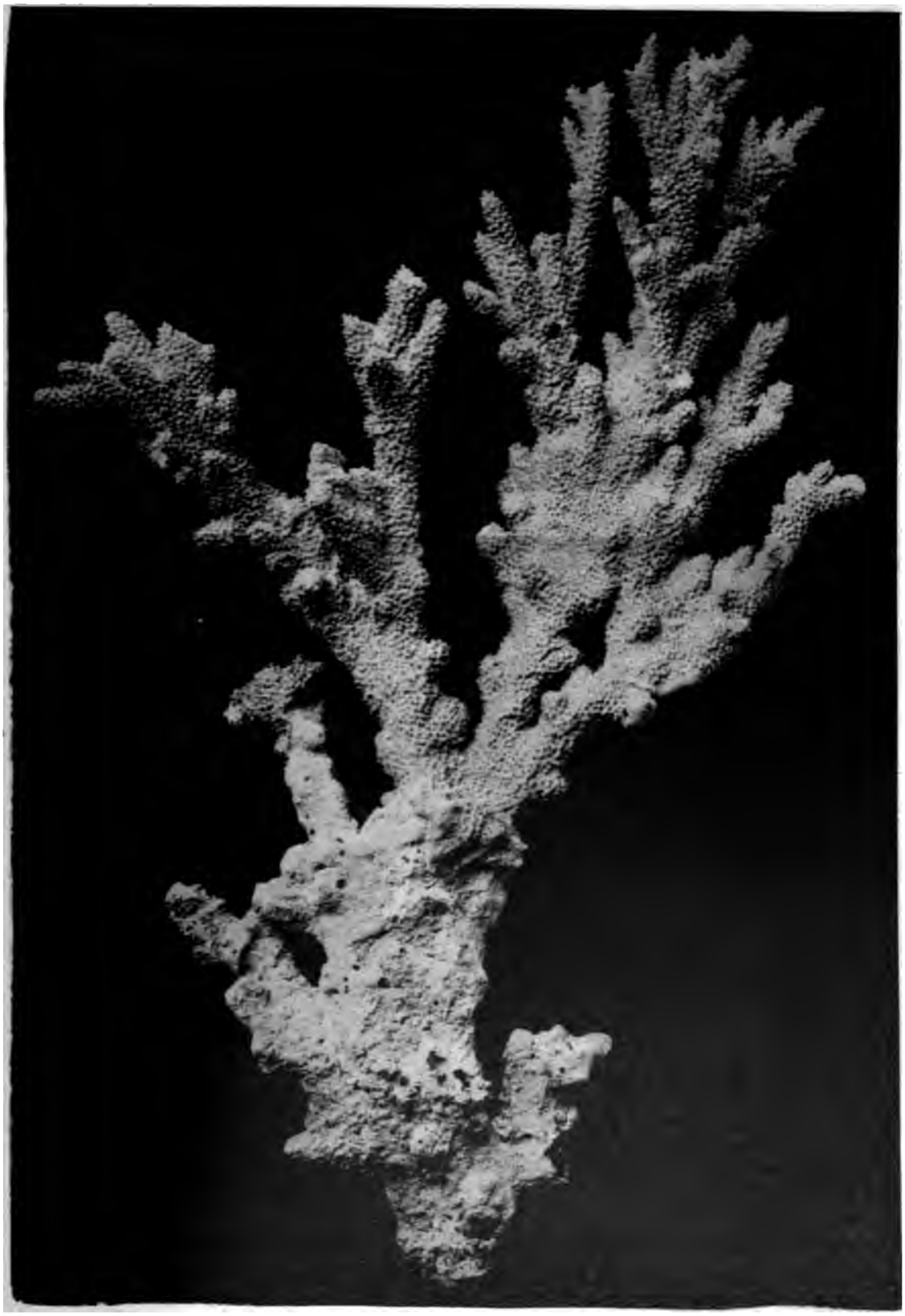


FIG. 2. ISOPORA MURICATA (LINN.). HEIGHT [illegible] CM.



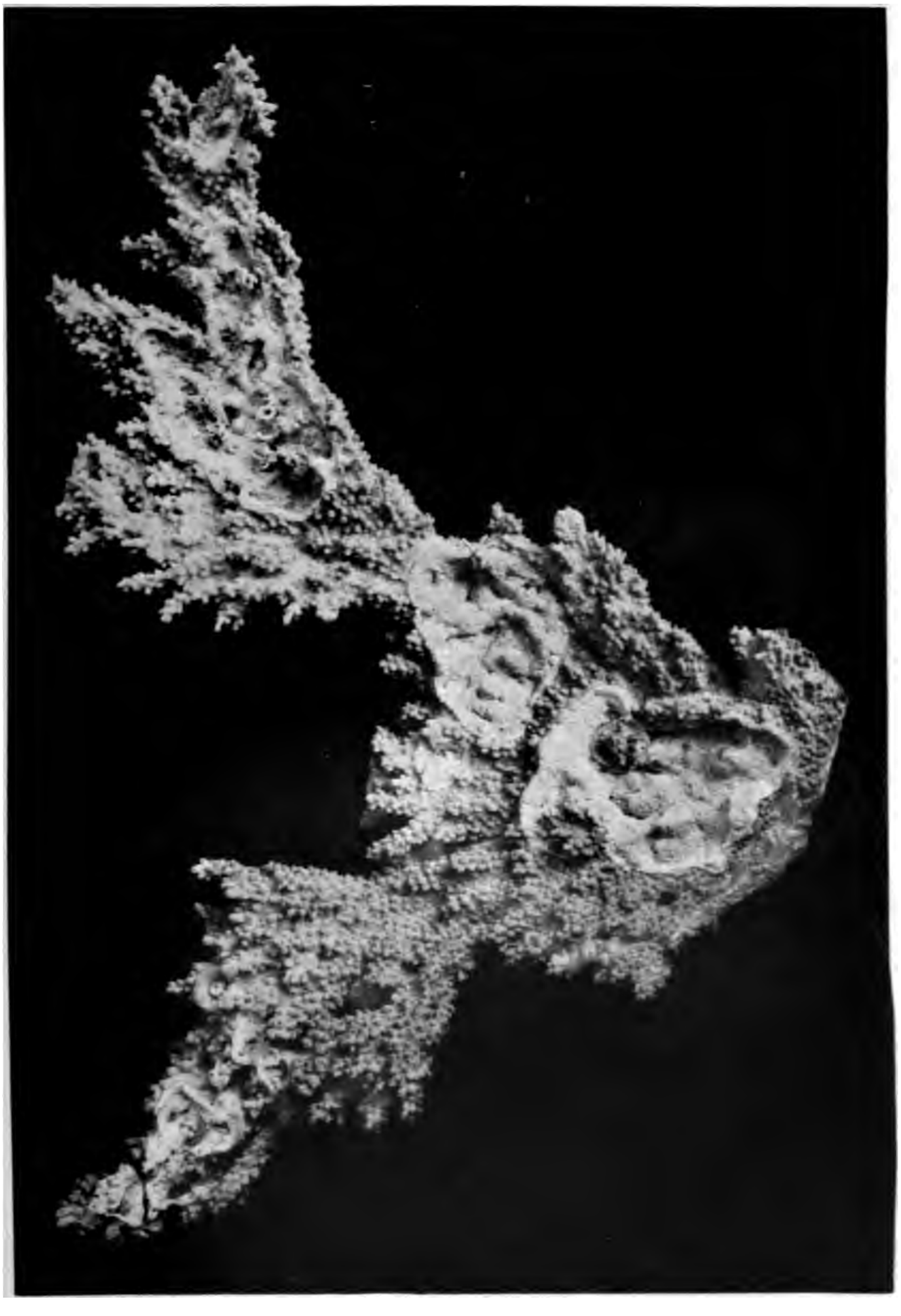
ISOPORA MURICATA FORMA PROLIFERA LAM., FROM DRY TORTUGAS, FLORIDA. HEIGHT, 35.5 CM.

HELIOTYPE PRINTING CO. BOSTON

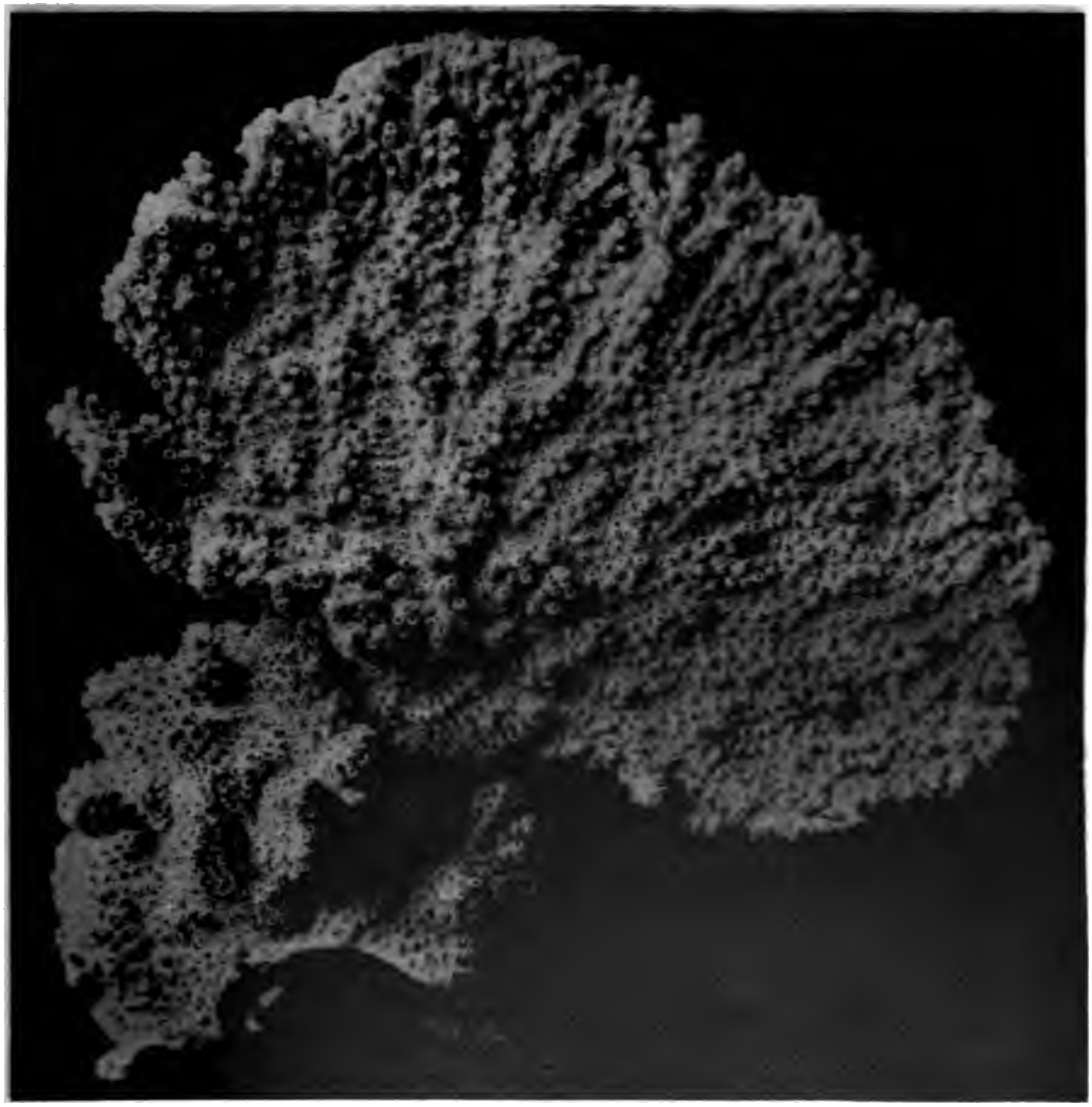


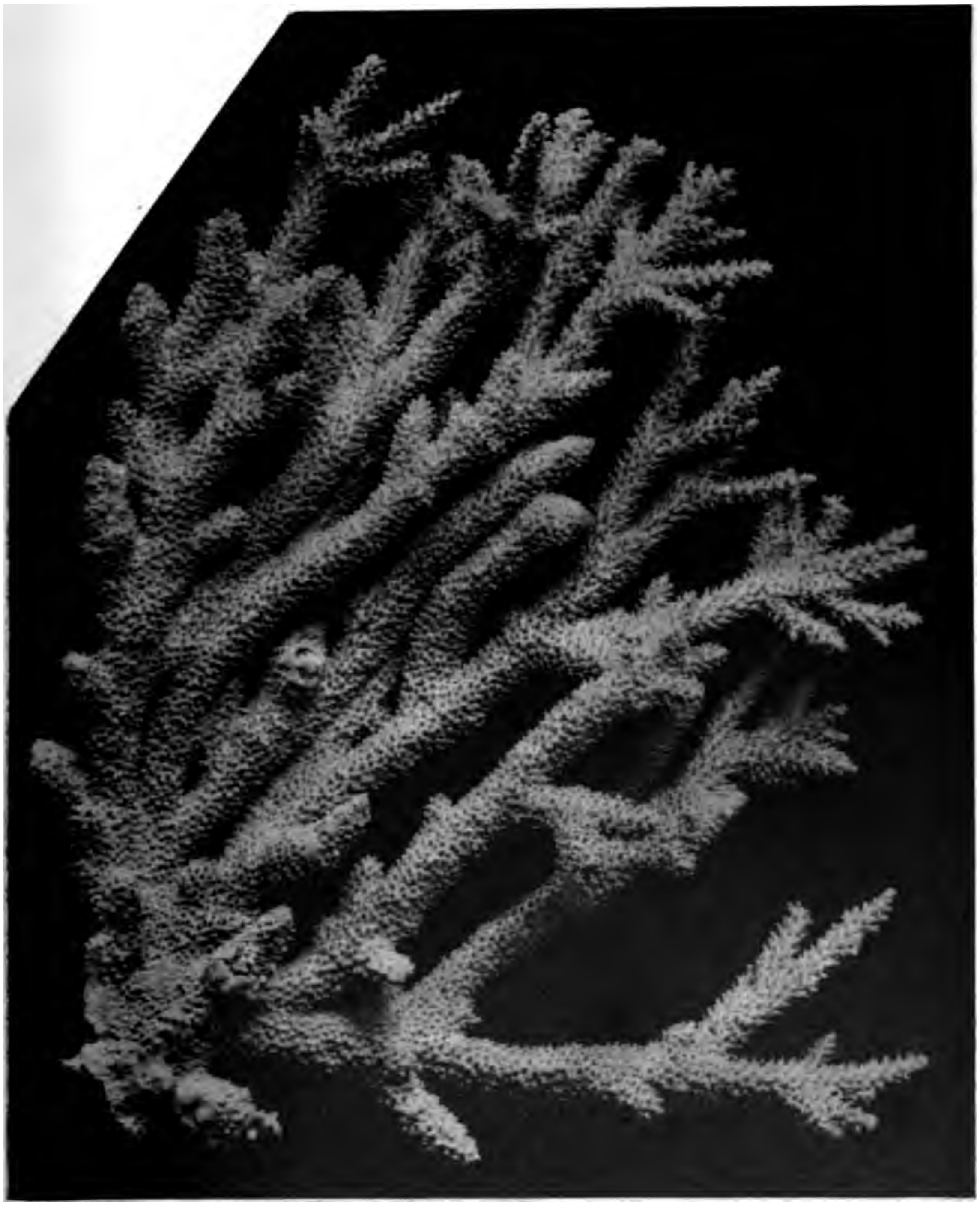
ISOPORA MURICATA FORMA PROLIFERA LAM., FROM DRY TORTUGAS, FLORIDA. HEIGHT, 51.3 CM.

HELIOTYPE PRINTING CO. BOSTON



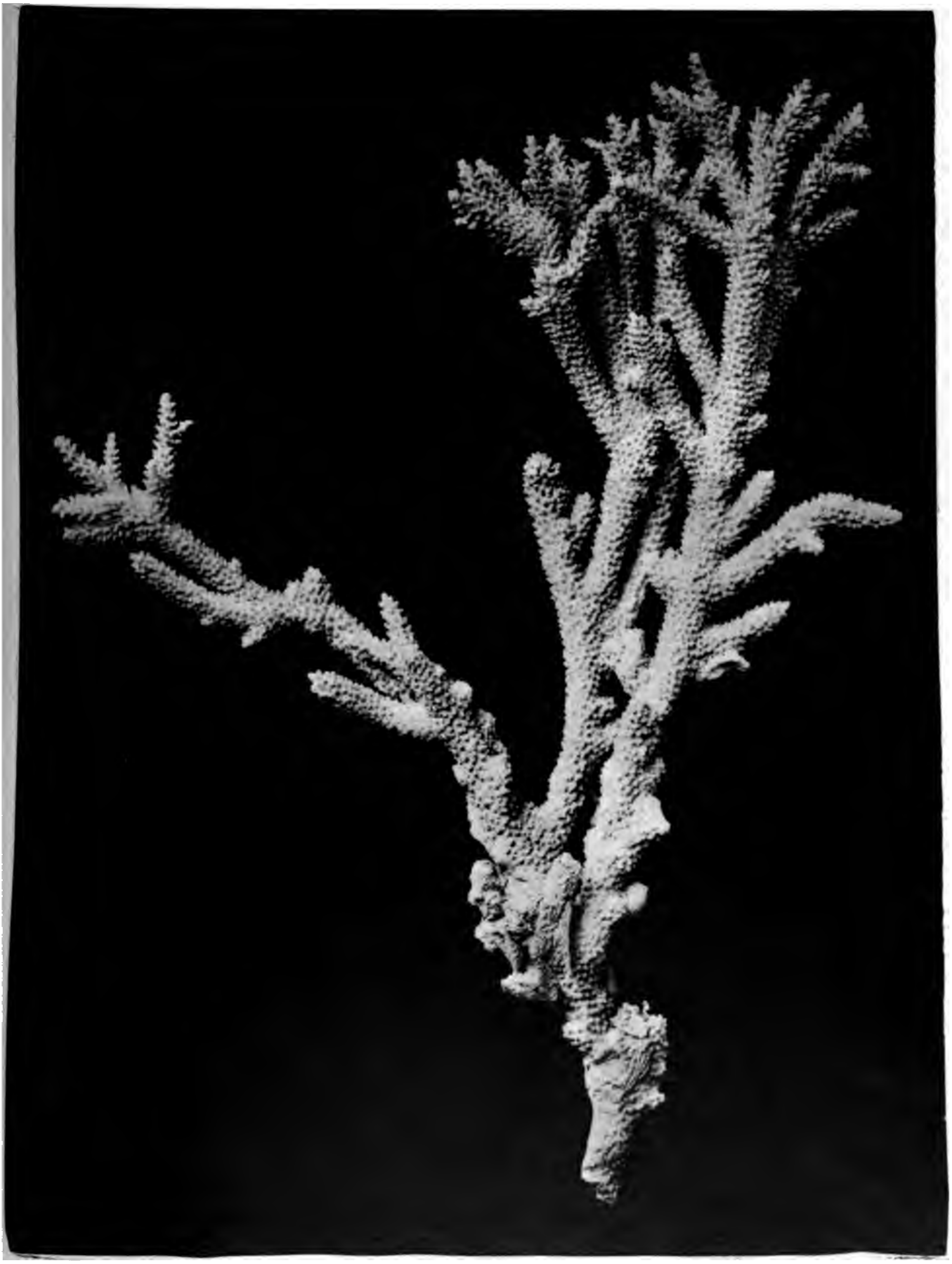
ROPORA MURICATA FORMA PALMATA LAMARCK. GREATEST BREADTH, 23.2 CM.





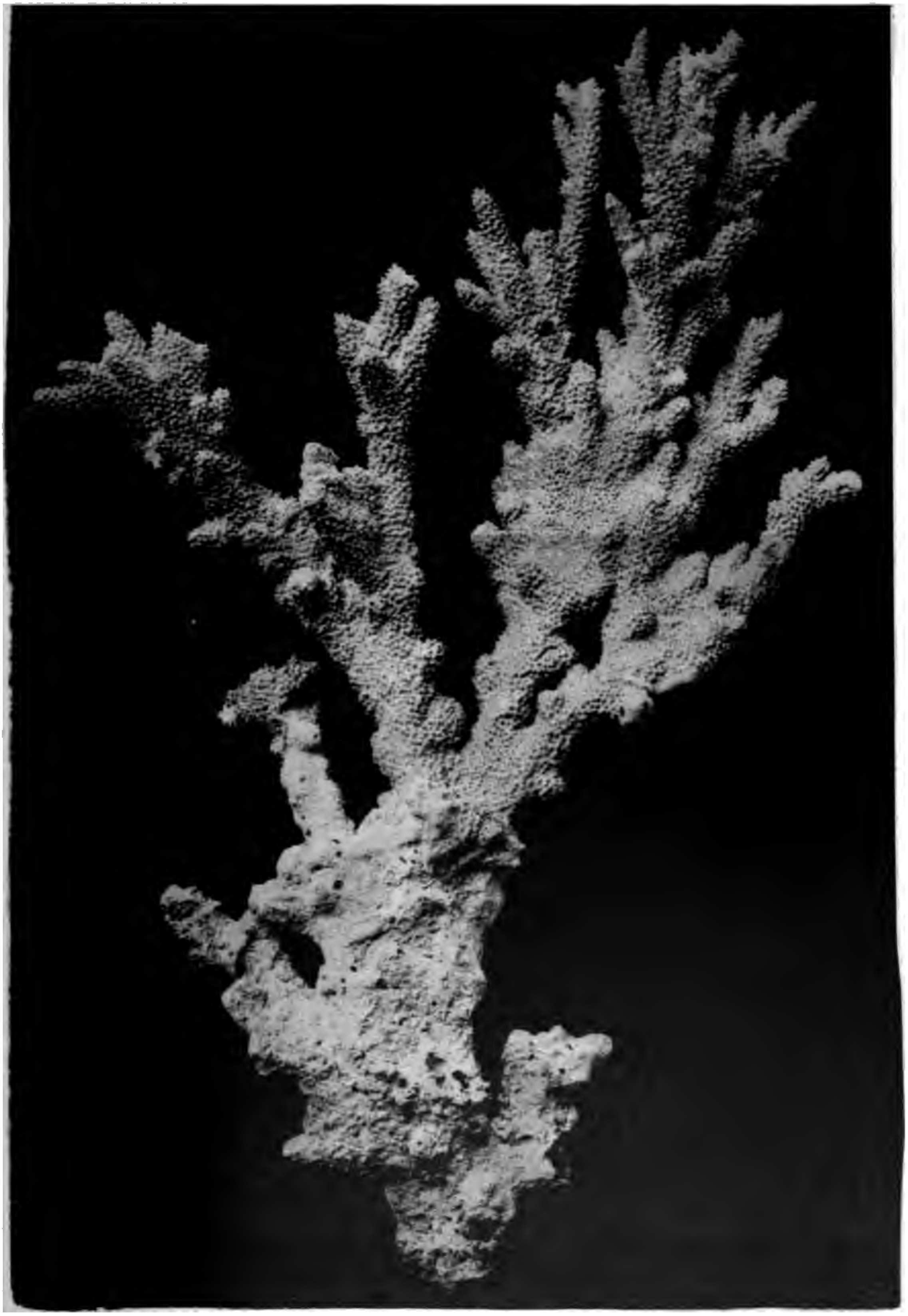
ISOPORA MURICATA FORMA PROLIFERA LAM., FROM DRY TORTUGAS, FLORIDA. HEIGHT, 35.5 CM.

HELIOTYPE PRINTING CO. BOSTON



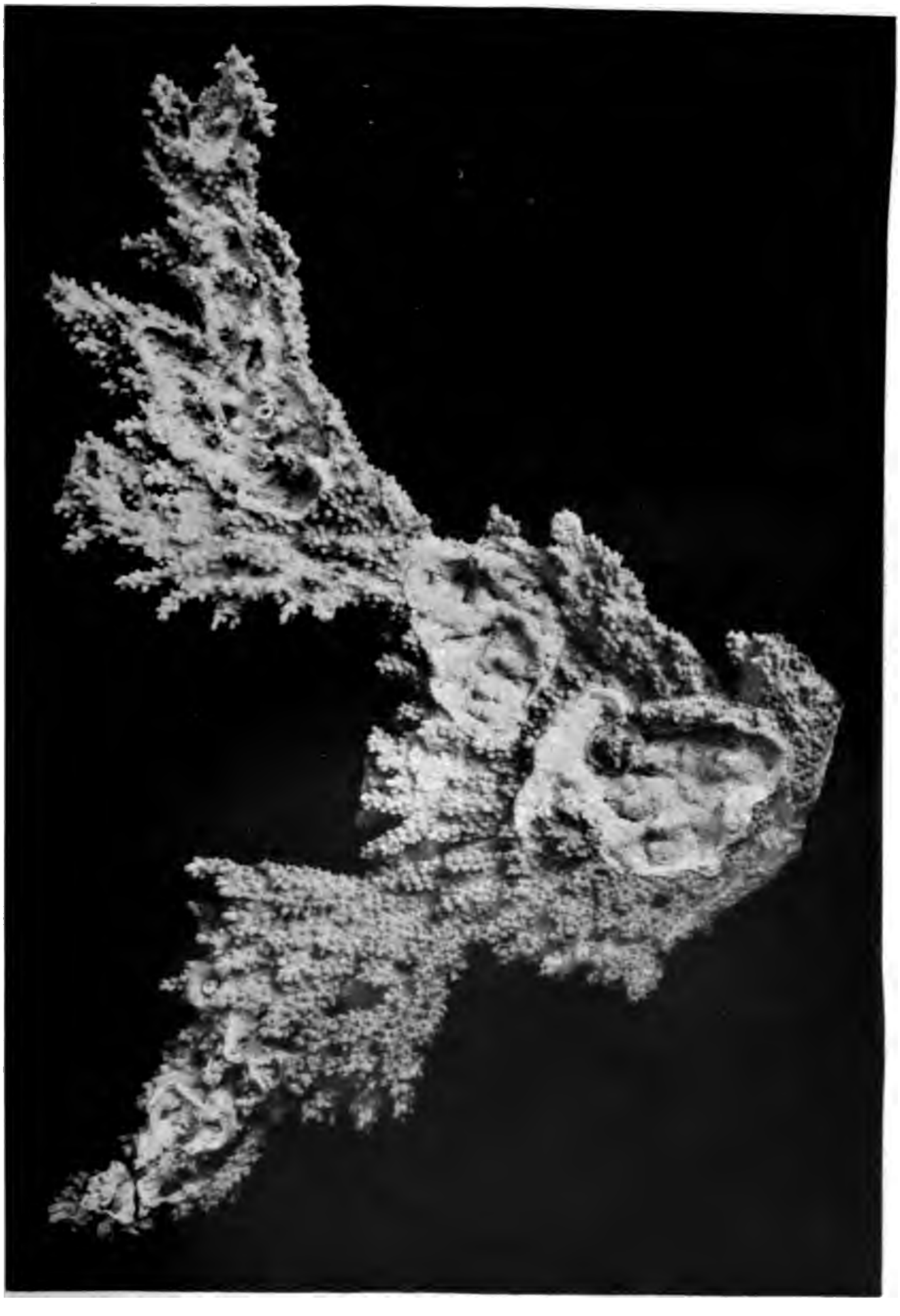
ISOPORA MURICATA FORMA PROLIFERA LAMARCK, FROM DRY TORTUGAS, FLORIDA. HEIGHT, 39.5 CM.

HELIOTYPE PRINTING CO., BOSTON



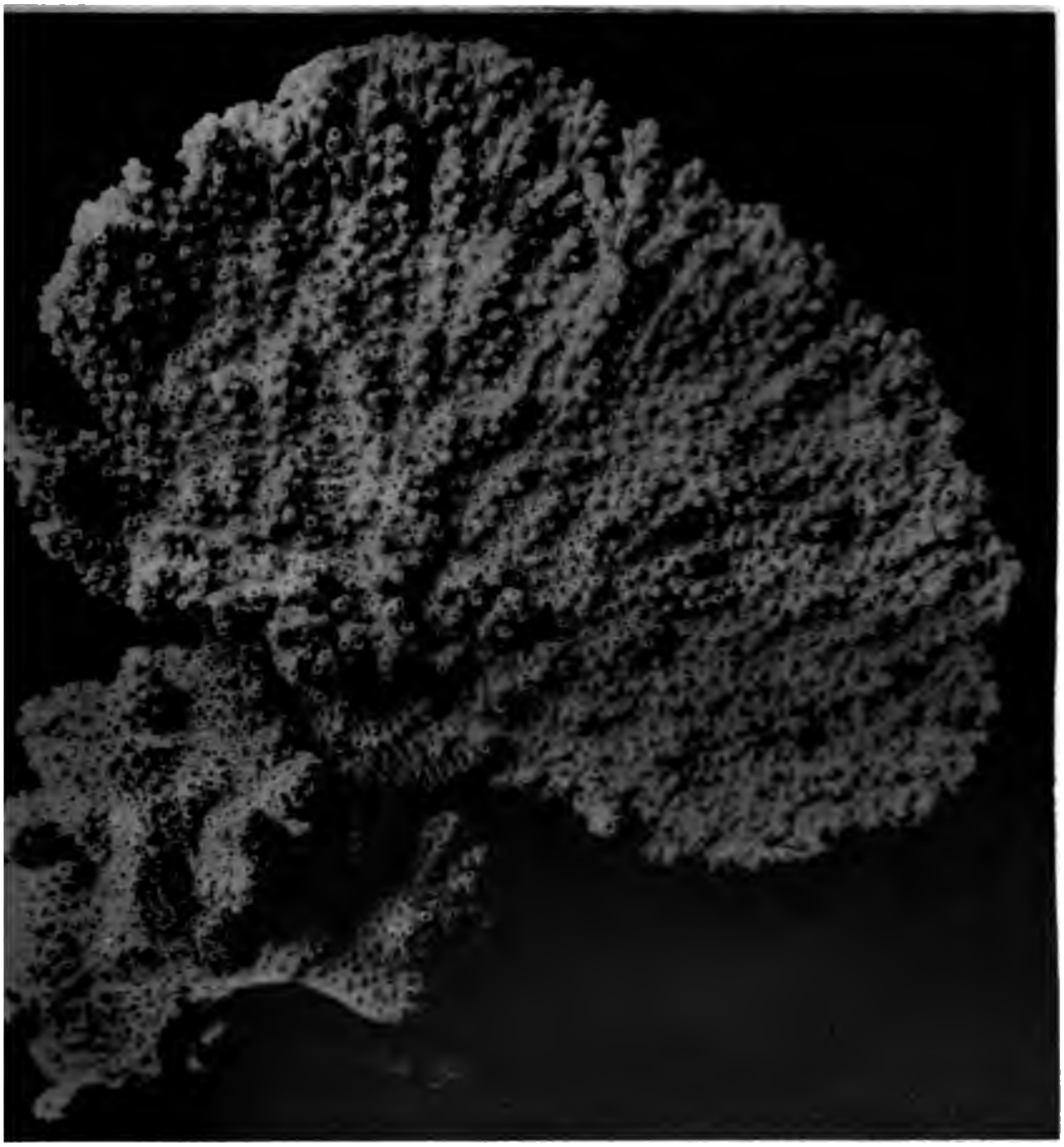
ISOPORA MURICATA FORMA PROLIFERA LAM., FROM DRY TORTUGAS, FLORIDA. HEIGHT, 51.3 CM.

HELIOTYPE PRINTING CO., BOSTON.

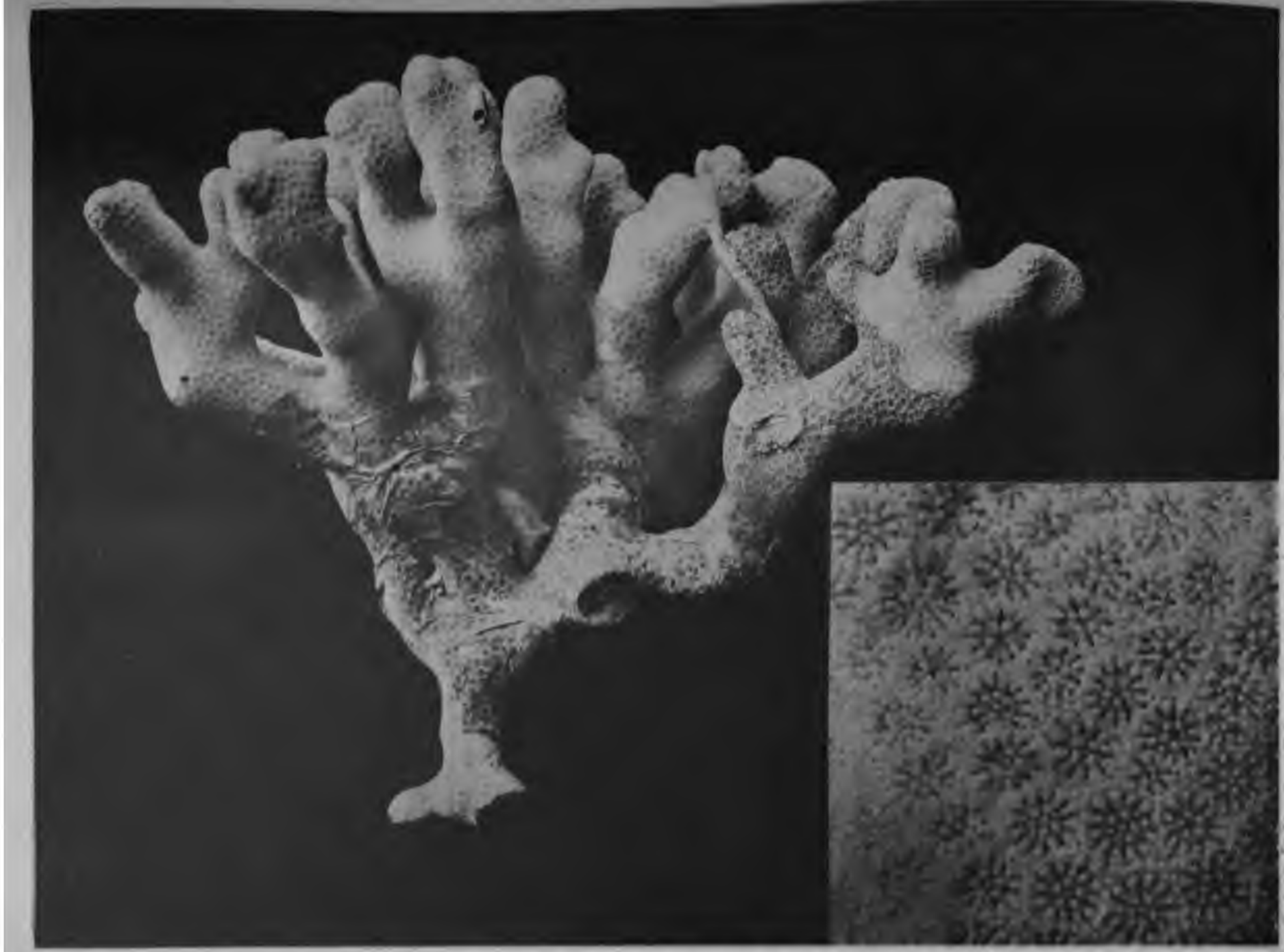


ISOPORA MURICATA FORMA PALMATA LAMARCK. GREATEST BREADTH, 23.2 CM.

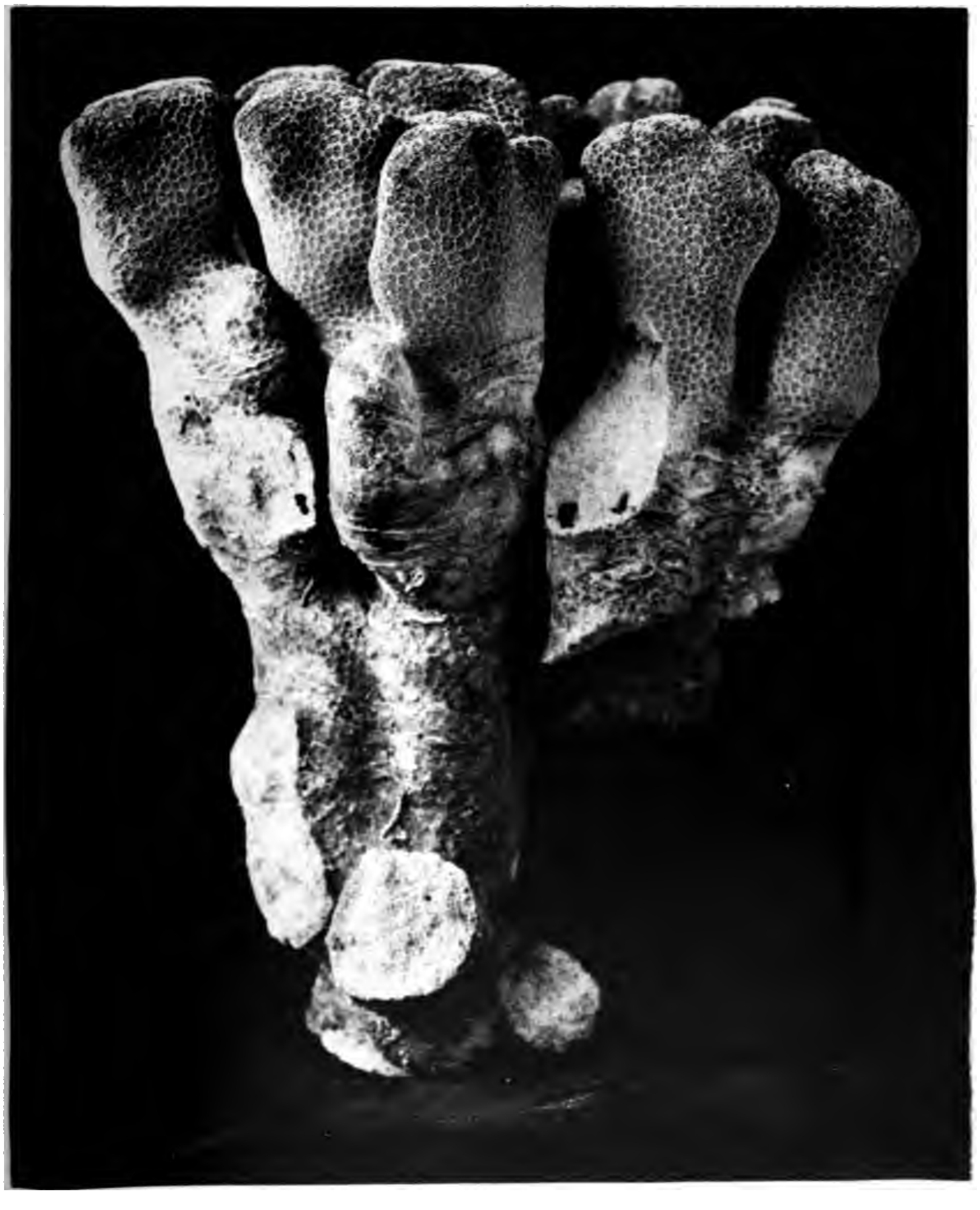
HELIOTYPE PRINTING CO. BOSTON.



ISOPORA MURICATA forma PALMATA LAM. BREADTH 14.8 CM.

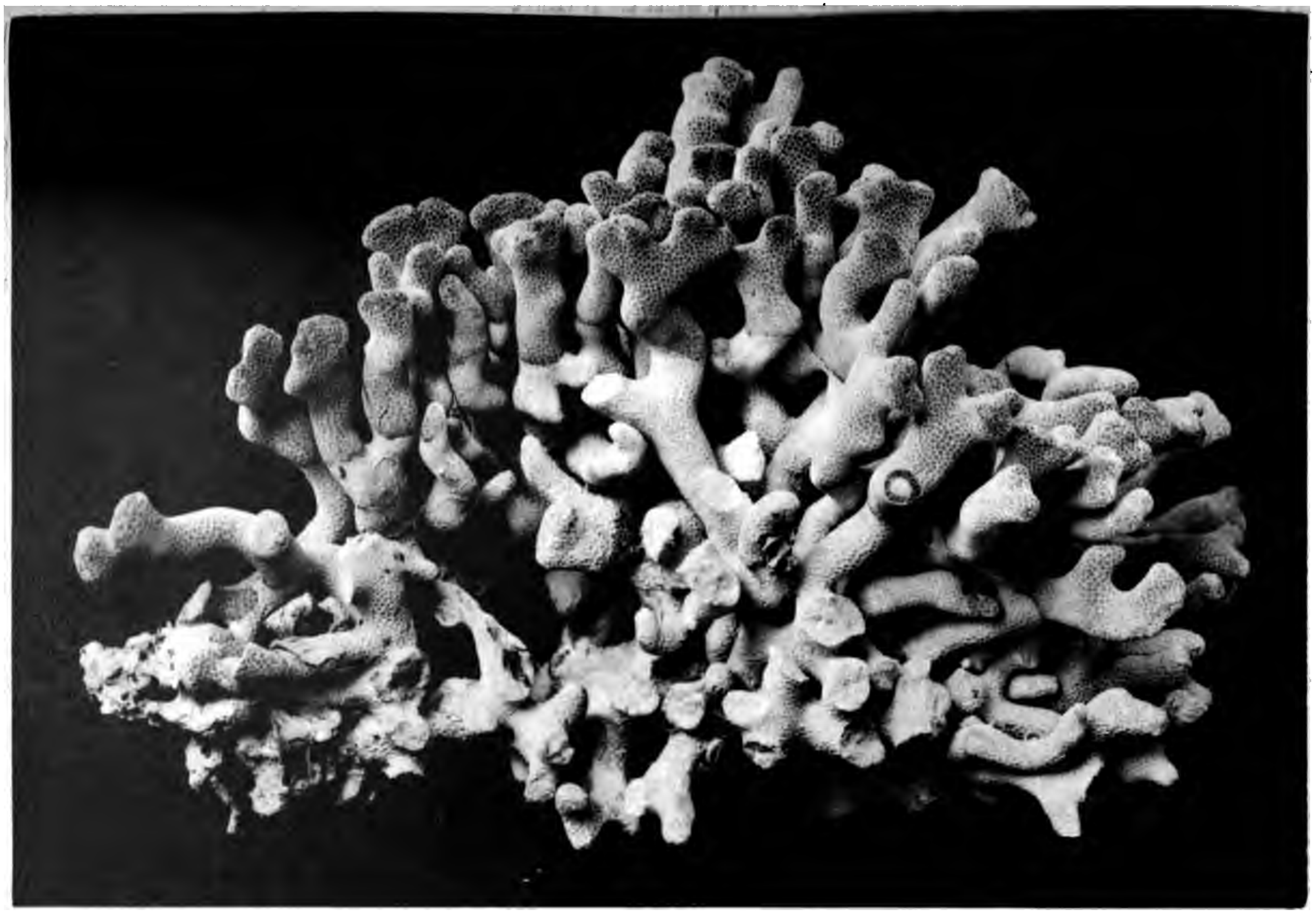


PORITES PORITES (PALLAS). SPECIMEN FROM CURAÇAO. HEIGHT 12.3 CM.; GREATEST BREADTH 16. CM
GENERAL VIEW OF CORALLUM AND VIEW OF PORTION WITH CALICES ENLARGED.



PORITES PORITES FORMA CLAVARIA LAM. HEIGHT OF SPECIMEN 14.5 CM.

HELIOTYPE PRINTING CO., BOSTON



[illegible] PORITE[illegible] [illegible] 26 CM.

[illegible]

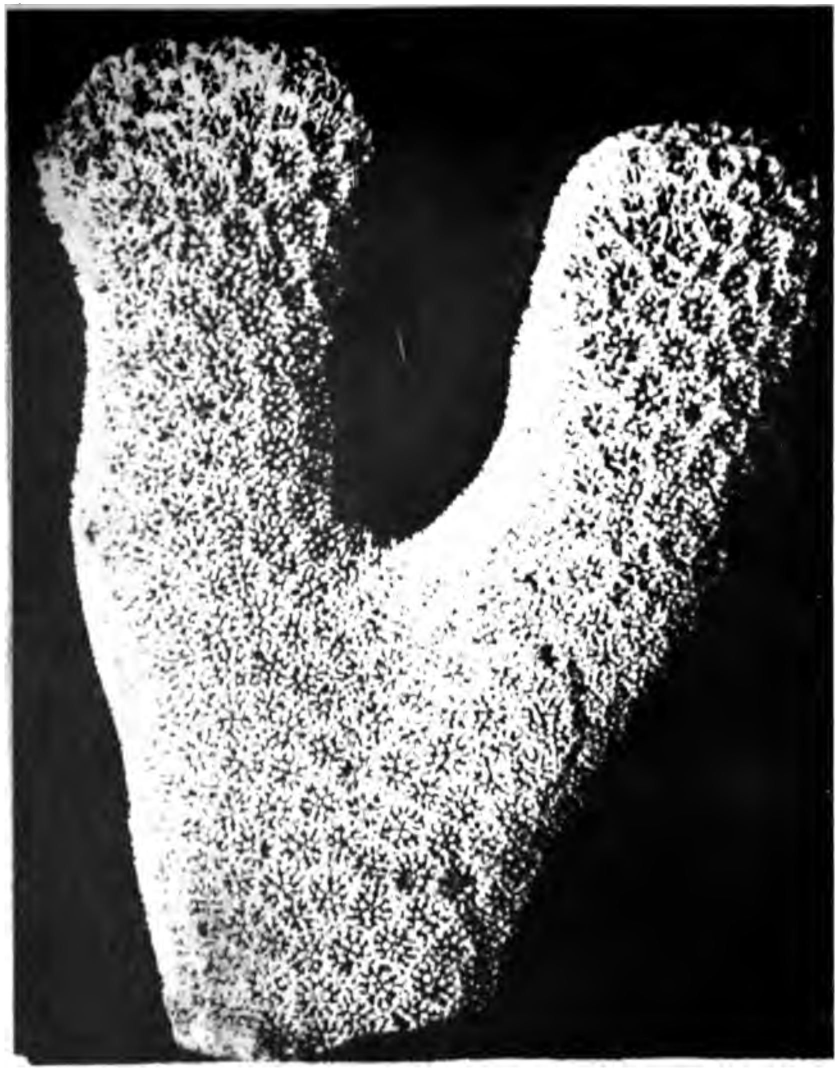


FIG. 1. PORITES PORITES forma FURCATA LAM. CALICES ENLARGED.

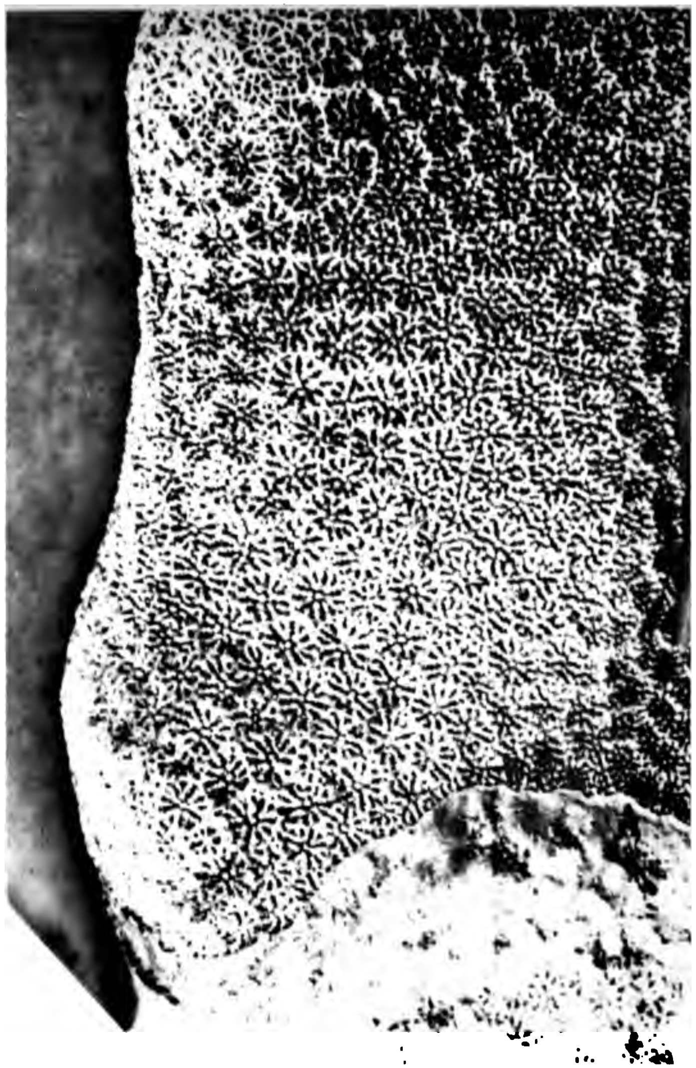
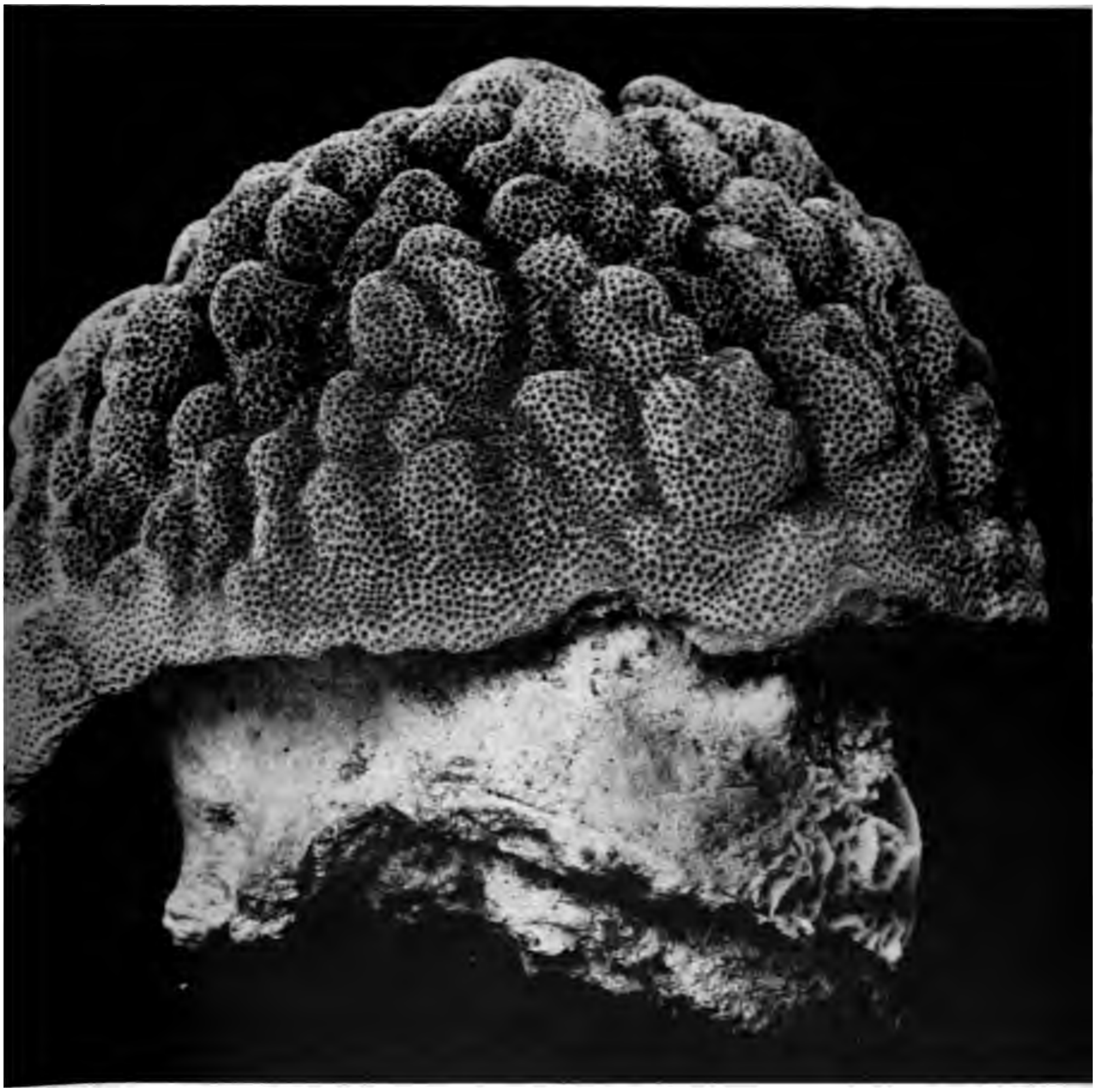


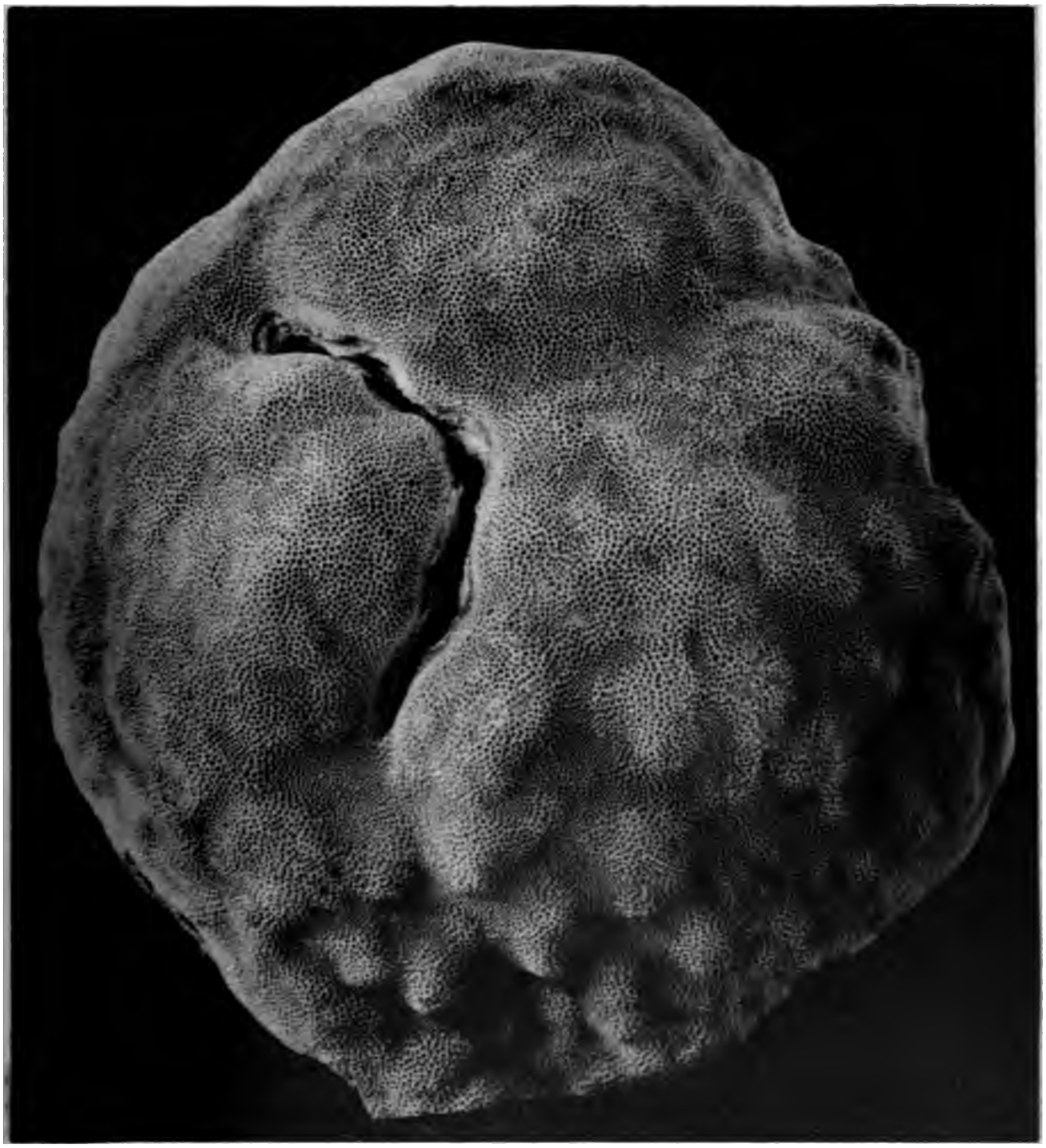
FIG. 2. PORITES PORITES forma CLAVARIA LAM. CALICES ENLARGED.

HELIOTYPE PRINTING CO. BOSTON.



PORITES ASTREOIDES LAMARCK, [illegible] HORIZONTAL DIAMETER OF SPECIMEN, 17.8 CM.

HELIOTYPE PRINTING CO. BOSTON



PORITES ASTRAEOIDES LAMARCK. [illegible] GREATER HORIZONTAL DIAMETER [illegible] CM.

[illegible] BOSTON

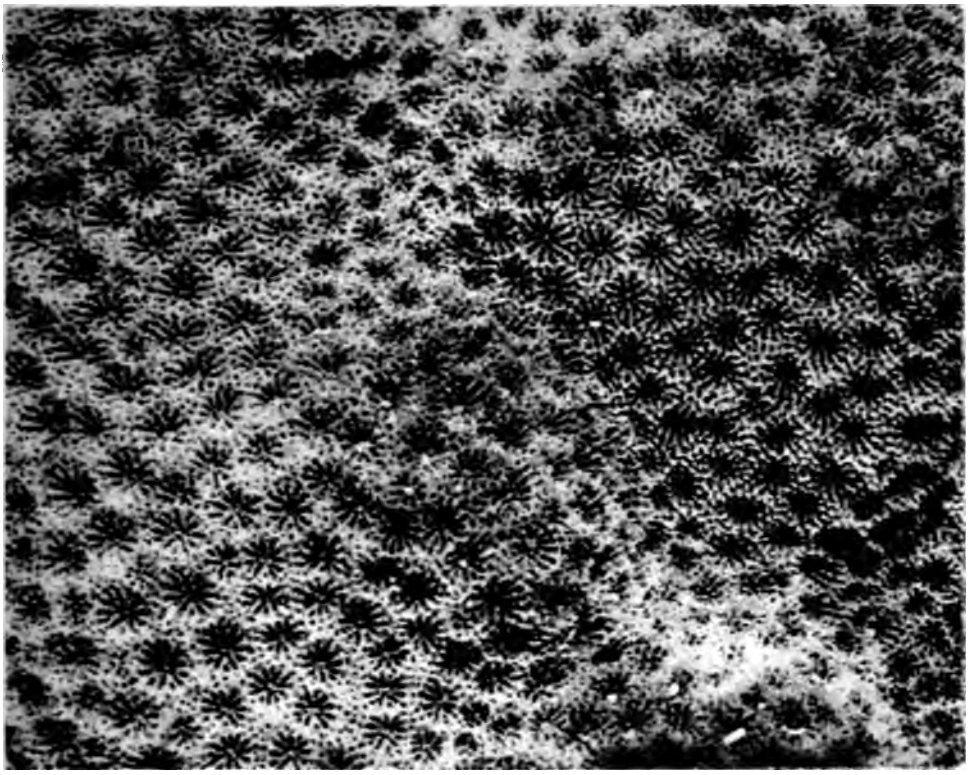


FIG. 1. PORITES ASTREOIDES LAM. FORMA *α*. CALICES ENLARGED.

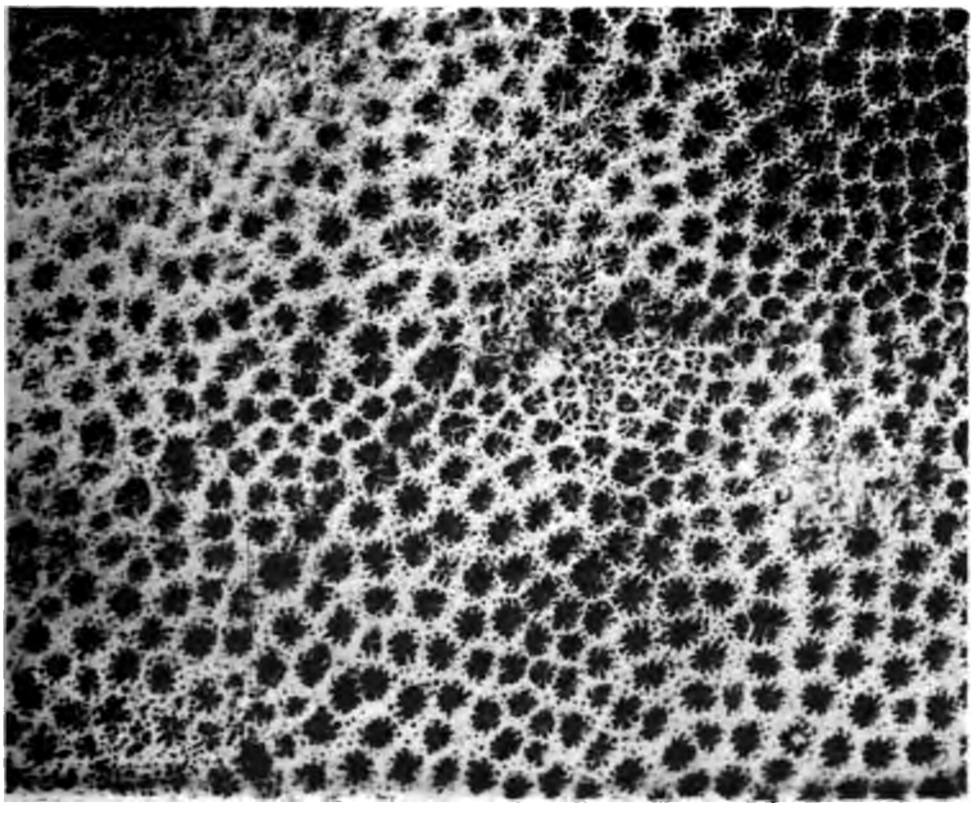
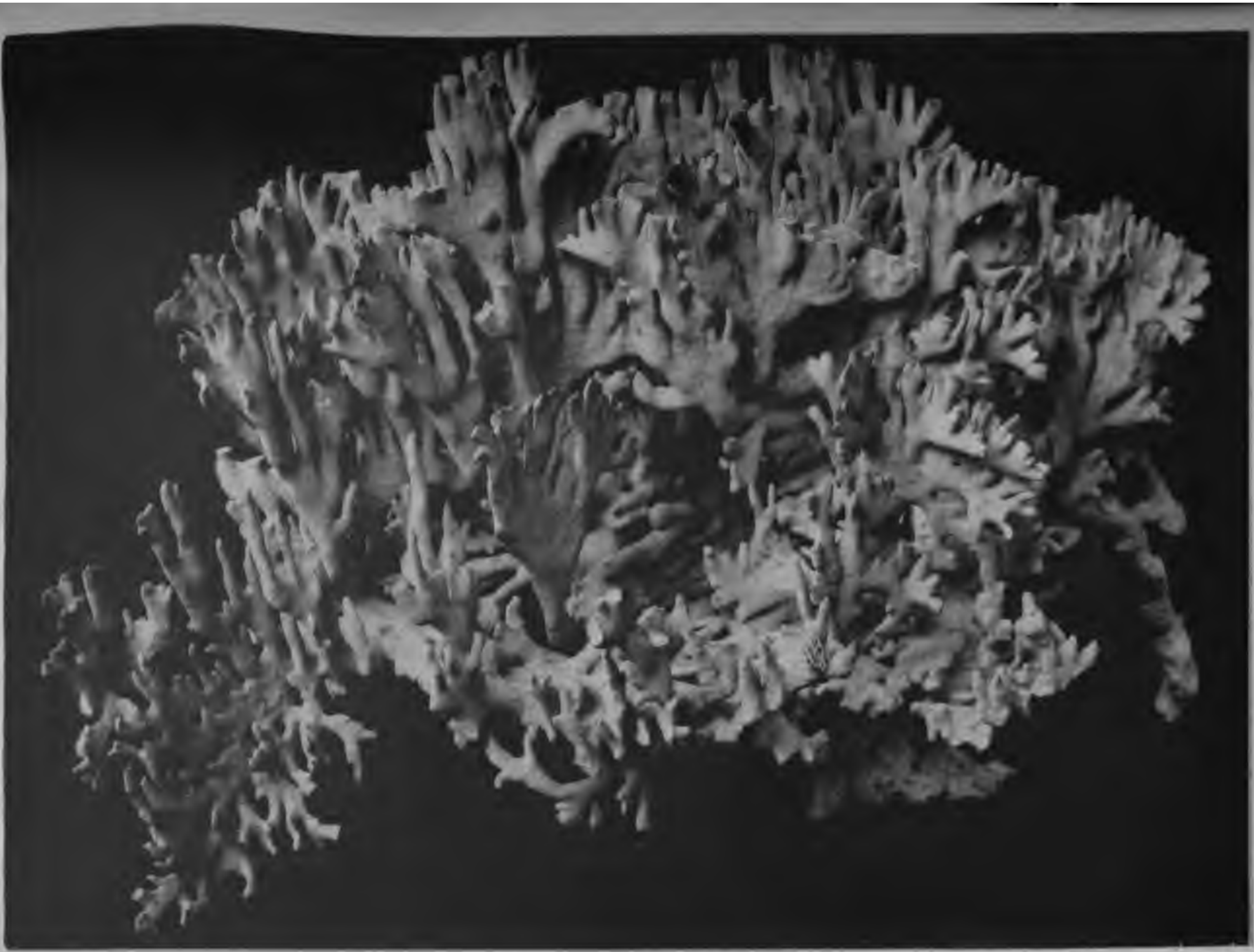
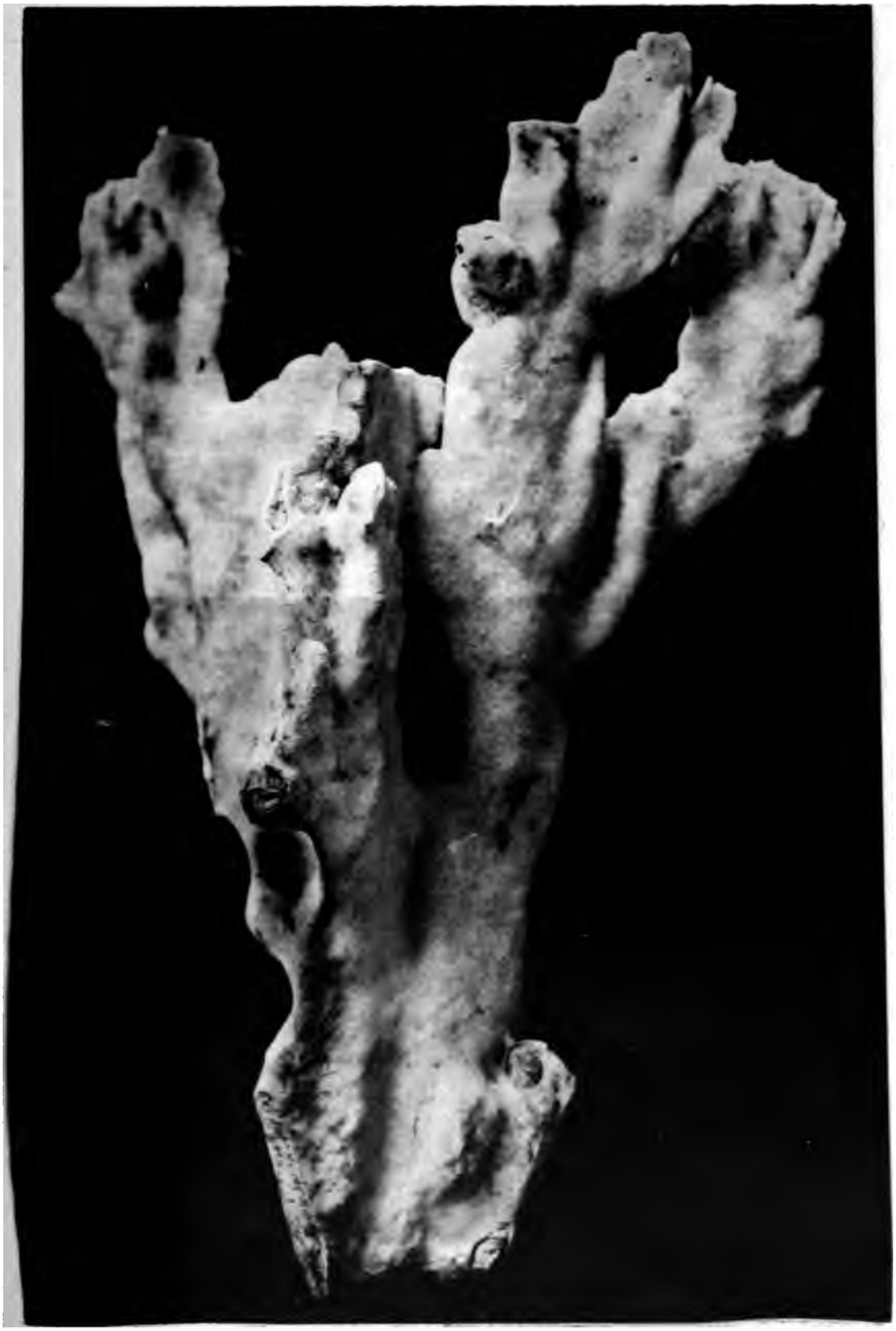


FIG. 2. PORITES ASTREOIDES LAM. FORMA *β*. CALICES ENLARGED.

HELIOTYPE PRINTING CO., BOSTON

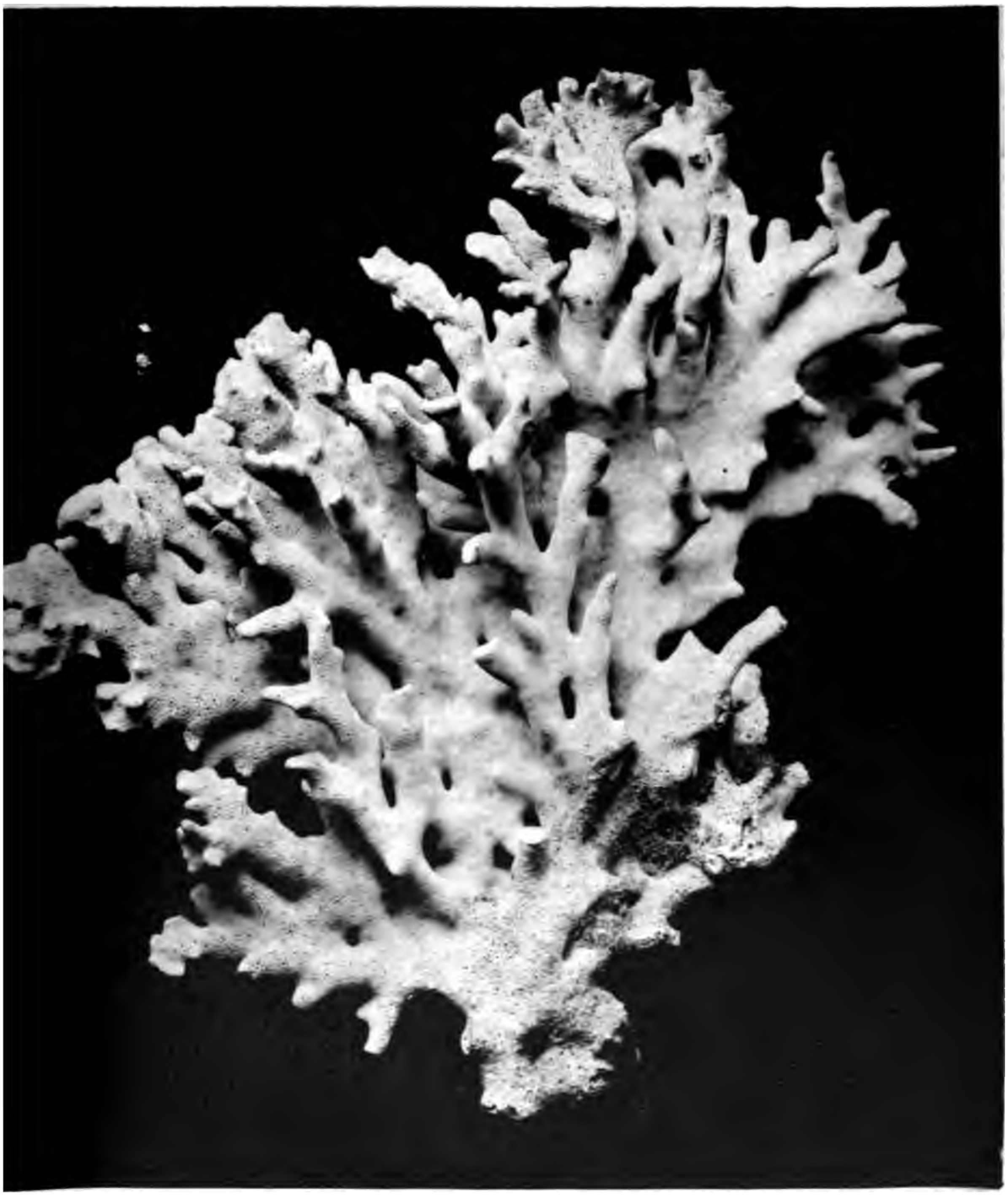


MILLEPORA ALCICORNIS LINN. DIGITIFORM VARIETY. GREATEST BREADTH, 35.5 CM.

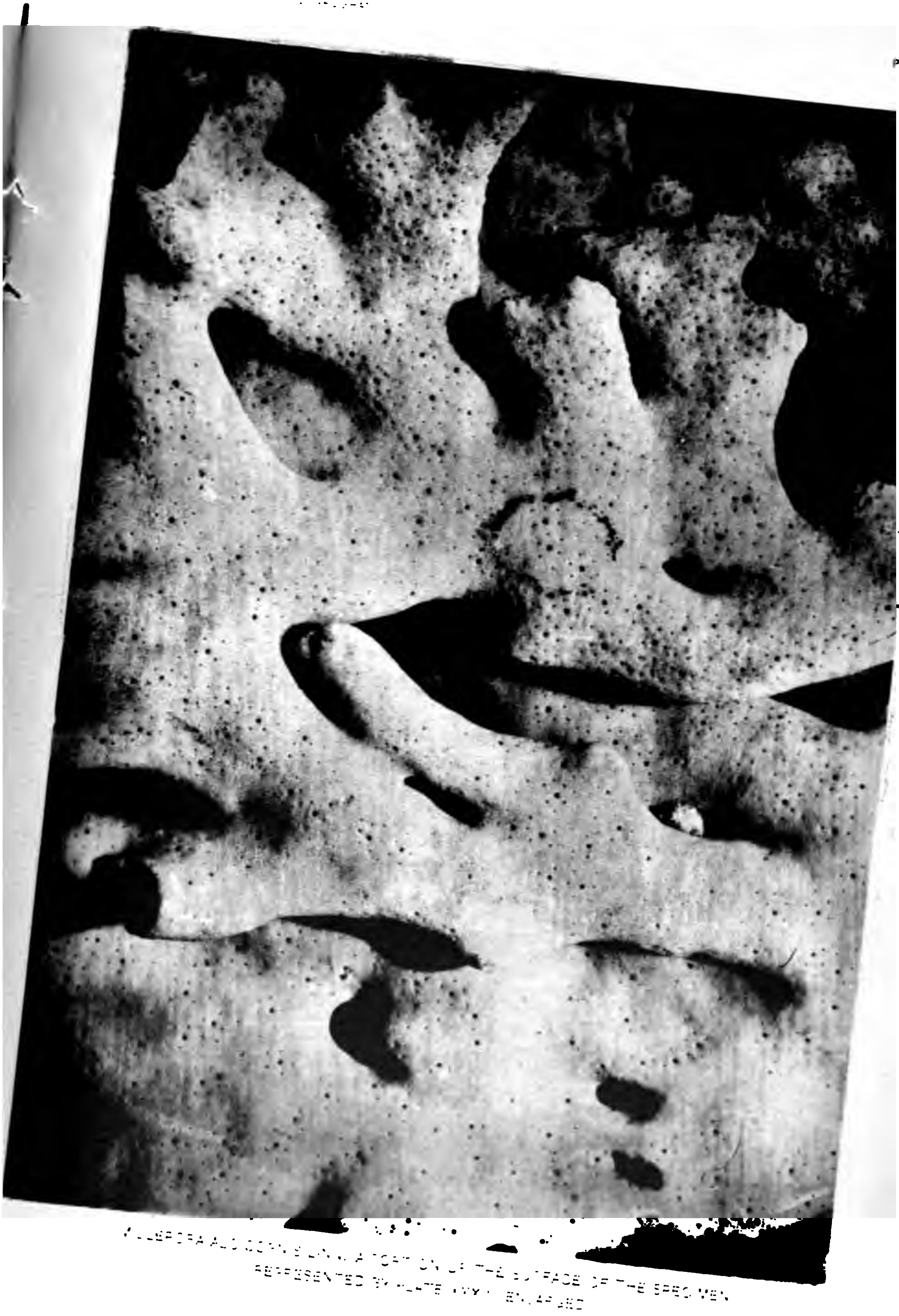


MILLEPORA ALCICORNIS LINN. VARIETY WITH FLABELLATE FRONDS. HEIGHT OF SPECIMEN, 28.5 CM.

HELIOTYPE PRINTING CO. BOSTON.



MILLEPORA ALCICORNIS LINN. A SMALL [illegible]



MILLEPORA ALCICORNIS LINNAEUS. A PORTION OF THE SURFACE OF THE SPECIMEN REPRESENTED BY PLATE XXXV, ENLARGED.

[illegible]

REPORT ON THE ACTINIANS OF PORTO RICO.

BY

J. E. DUERDEN, Ph. D., A. R. C. Sc. (Lond.),
Bruce Fellow, Johns Hopkins University.

REPORT ON THE ACTINIANS OF PORTO RICO.

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The collection of Actiniaria secured by the United States Fish Commission steamer *Fish Hawk* from around Porto Rico supplements in many ways the results of several recent writers on the West Indian Actinian fauna. Within the past few years Prof. J. P. McMurrich (1889, 1889*a*, 1896, 1898) has studied the Actinians of the more northern Bahamas and Bermudas, and also a few specimens from Cuba; Prof. A. E. Verrill (1898, 1899, 1900) has added several species to the Bermudan list and introduced certain changes in nomenclature and synonymy; I have recorded nearly 40 species from around Jamaica (1898, 1898*a*, 1900) and described the *Zoantheæ* and *Stichodactylinæ* more fully. Among older writers Lesueur (1817) described a number of species found mainly around the Lesser Antilles, but Duchassaing & Michelotti, in their "Mémoire sur les Coralliaires des Antilles" and "Supplement" (1860, 1866), first made known to any degree of completeness the peculiarities and richness of the Actinian fauna of this region. Dr. O. Carlgren (1900*a*) has recently had the opportunity of examining in Turin the Actiniarian collections of Duchassaing & Michelotti, and gives the relationship of several whose identity has been somewhat doubtful. The West Indian Actiniaria, including also those of the Bermudas, are now probably as well known as those of most areas, although owing to the incompleteness of the description of many of the earlier species, and the difficulties involved in the specific study of genera such as *Palythoa* and *Zoanthus*, many synonymic difficulties have been introduced.

With two exceptions the species represented in the *Fish Hawk* collections are such as occur in abundance in the shallow waters around Jamaica, and the majority are also recorded from the Bahamas and the Bermudas. One species, which I have named *Bunodosoma spherulata*, seems to be new, and such will probably be the case with a single specimen of *Cerianthus*. Already most of the others have been fully described and figured among the writings of the authors above mentioned, but in order to make the report more complete brief descriptions are again given, the details obtainable from the preserved material being supplemented by observations made on the living polyps elsewhere.

Before proceeding with the description of the species some remarks are necessary upon the great changes which the classification of the *Actiniaria* is at present undergoing. All the most recent researches on their anatomy and development indicate that the Actinians are divisible into three main groups—*Ceriantheæ*, *Zoantheæ*, and *Hexactiniæ*, and representatives of all these occur in the present collection. The subdivision is based upon the method of increase of the mesenteries beyond the primary pairs, the order being fundamentally different in the three groups, and leading to adult conditions of the highest significance in Actinozoan morphology.

Although the developmental evidence is not altogether complete, all the facts we possess point to the conclusion that the primary six pairs of mesenteries (Protocnemes) arise practically in the same manner throughout the *Hexactiniæ* and *Zoantheæ*, that is, as bilateral pairs (a corresponding mesentery on each side of the principal axis), first toward one aspect of the polyp, then toward the other. In the *Cerianthex* only four of the six pairs of protocnemes seem to be developed; the fifth and sixth pairs, which often remain incomplete in other *Actiniæ*, perhaps never appear. According to van Beneden (1897), however, the development of the primary mesenteries in the *Cerianthex* does not admit of comparison with that in the two other groups.

In the three divisions the later mesenteries (Metacnemes) are added in a manner differing altogether from that followed by the primary mesenteries, the method varying in each of the three groups. In the *Ceriantheæ* they continue to arise as bilateral pairs at what has been regarded as the dorsal aspect of the polyp; in the *Zoantheæ* they are added as unilateral pairs (that is, the two mesenteries of a pair are adjacent on one side of the axis) at two regions, one on each side of the sulcar directives, each pair consisting of a small and a large mesentery; in the *Hexactiniæ* new mesenteries beyond the protocnemes appear in unilateral pairs, within the primary exocœles of the protocnemes. In the last group they arise either simultaneously or in successive pairs on each side, the succession being either from the dorsal to the ventral aspect of the polyp or vice versa. The mesenteries and other organs of the *Ceriantheæ* and *Zoantheæ* preserve in the adult a strong bilaterality, while in most *Hexactiniæ* they usually ultimately attain a biradial symmetry. The separation of the three groups is accentuated by other characters given in their definitions, but the order of appearance of the metacnemes and their disposition in the adult are the characteristics of primary importance. The bilateral mesenterial arrangement occurring in the *Ceriantheæ* and *Zoantheæ* is representative of a much more ancient type of Actinozoan development than is the cyclic plan followed by the *Hexactiniæ*. The characteristics of the three types are diagrammatically represented in fig. 1, on the text plate opposite.

The *Edwardsiæ*, *Halcampeæ*, *Protactiniæ*, and others have been proposed as Actiniarian tribes of equivalent value to the three above mentioned, but as regards their mesenteries they merely exhibit one or other of the developmental stages of the *Hexactiniæ*, without introducing any new type of mesenterial sequence. Any other characters possessed by them are only of subtribal or less importance.

Formerly regarded as only tribal subdivisions of the *Actiniaria*, the *Ceriantheæ*, *Zoantheæ*, and *Hexactiniæ* have now been raised to the rank of Actinozoan groups of equivalent value to those of the *Alcyonaria* and *Antipatharia*. Carlgren (1898, 1900*a*) has proposed that the terms *Ceriantharia*, *Zoantharia*, and *Actiniaria*, respectively, should replace the tribal names above given. Much objection is to be taken against using the old familiar and more comprehensive names *Zoantharia* and *Actiniaria* in such a restricted manner, but rather than introduce any synonymous terms at this critical stage of growth of our knowledge of the relationships of the Actinozoa I have adopted them in the present paper, though convinced that they should not be ultimately accepted.

PLATE A.

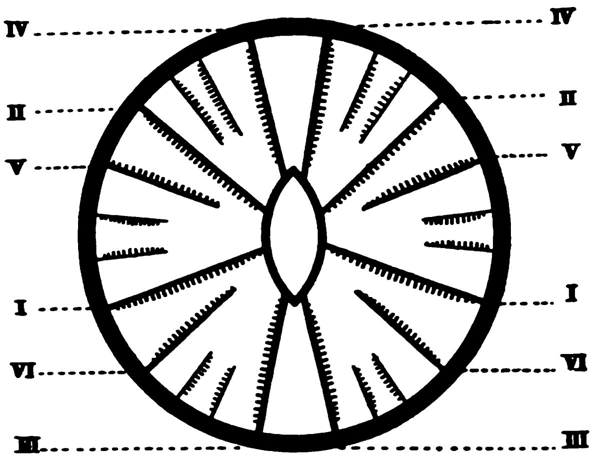

FIG. 1.—Diagrammatic representation of a stage in the development of a Hexactinian polyp. The six bilateral pairs of mesenteries numbered I to VI, and indicated by thicker lines, are the protocnemes, the fifth and sixth pairs being as yet incomplete; pairs III, III and IV, IV, respectively, represent the ventral and dorsal directives. In each of the six primary exocœles a unilateral pair of metacnemes has appeared, the sequence being bilateral, and from the dorsal to the ventral aspect of the polyp. At a later stage all the primary mesenteries become complete, and form a first cycle; the six pairs within the primary exocœles attain practically a uniform size, and constitute a second alternating cycle. Other unilateral pairs may arise in the exocœles between the members of the first and second cycles, and give rise to third, fourth, or fifth alternating cycles. Owing to the presence of directives the polyps attain only a biradial symmetry.

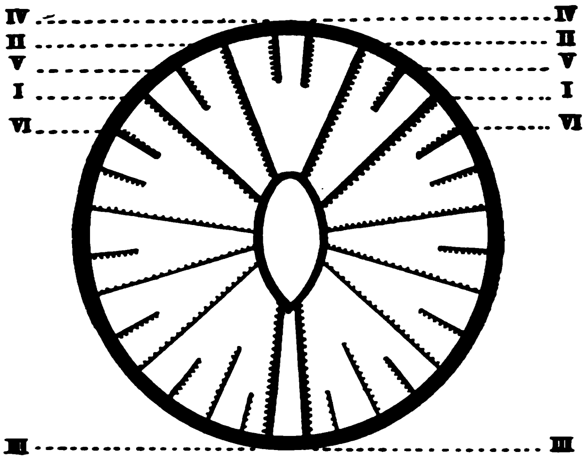

FIG. 2.—Diagrammatic representation of mesenteries in a brachytypic Zoanthid. As in previous figure the thicker mesenteries numbered I to VI are the protocnemes. The fourth (dorsal directives), fifth, and sixth pairs are permanently incomplete, except in the Macrocneminæ, where the sixth pair becomes complete. The metacnemes are all developed within the exocœle on each side of the ventral directives, and are arranged in unilateral pairs consisting of a brachycneme and a macrocneme. The mesenteries remain acyclic and the polyps exhibit bilateral symmetry.

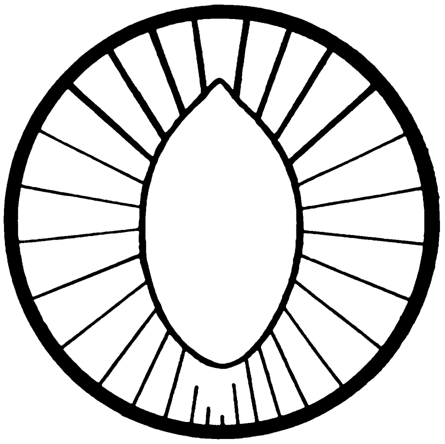

FIG. 3.—Diagrammatic arrangement of the mesenteries in *Cerianthus*. The four bilateral pairs represented by thicker lines have generally been considered to correspond with the Edwardsian mesenteries (I to IV) of Hexactinian and Zoanthid polyps, but according to van Beneden no such comparison can be maintained. New mesenteries are added as bilateral pairs at only one axial region of the polyp. According to Carlgren, this is the ventral or posterior aspect. The mesenteries remain acyclic and the polyps possess bilateral symmetry.

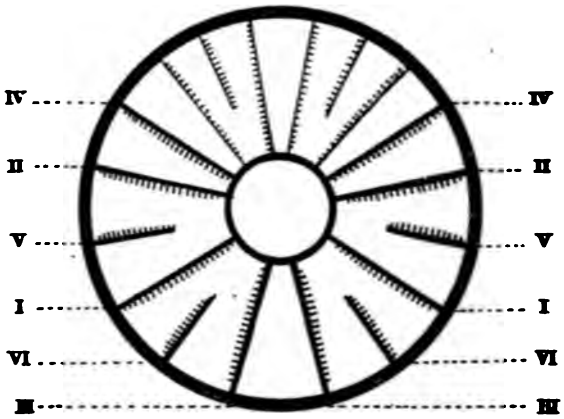

FIG. 4.—Diagrammatic arrangement of the mesenteries in a polyp of the coral *Porites*. Usually only the six protocnemes are developed in adult polyps, the Edwardsian pairs alone complete. Additional mesenteries sometimes arise as bilateral pairs within the entocœle of either the dorsal or ventral pairs of directives; in the figure three new pairs have appeared within the dorsal directive entocœle. The mesenteries remain acyclic and the polyps exhibit bilateral symmetry.

E. van Beneden (1897) in his great work, "Les Anthozoaires de la Plankton-Expedition," has come to the conclusion that the *Ceriantharia* should be entirely removed from among the Actinians, as generally understood, and united with the *Antipatharia* to form a single group, *Ceriantipatharia*. In a similar manner he unites the *Actiniaria* (restr.) with the *Madreporaria* under the term *Hexactiniaria*. The evidence for the relationship of the *Ceriantharia* and *Antipatharia* is mainly embryological, and concerns the mode of origin of the first pairs of mesenteries and their associated chambers.

The character of greatest importance among the *Ceriantharia* is the appearance of the metacnemes in bilateral pairs at only one region of the polyp. Since the publication of van Beneden's work I have found that a somewhat similar method of mesenterial increase is followed by the coral *Porites* (1900), the other characters of which undoubtedly mark it out as a Hexactiniarian. The mesenteries beyond the primary six pairs appear in bilateral pairs within the entocœle of either the dorsal or ventral pair of directives (fig. 4, plate A). This discovery must be considered as modifying in some degree the strong separation from the *Actiniaria* which van Beneden has tried to establish for the *Ceriantharia*.

The arrangement proposed by van Beneden (p. 182) is as follows:

- Cnidaria . .
  - Anthozoa=Scyphozoa .
    - Zoanthactiniaria . .
      - Zoanthiniaria [=Zoantheæ.]
      - Hexactiniaria . . . . .
        - Madreporaria.
        - Actiniaria.
    - Octactiniaria.
    - Scyphactiniaria . . .
      - Ceriantipatharia . .
        - Ceriantharia.
        - Antipatharia.
      - Scyphomedusa.
      - Rugosa.
  - Hydrozoa.

As the report was approaching completion I received the valuable paper "Ostafrikanische Actinien," 1900*a*, by Dr. Oskar Carlgren. As a contribution to the systematic study of the *Actiniæ* the work is of great importance, and calls for lengthy notice, especially as many of the present West Indian species are therein referred to. The author introduces a classification of the *Actiniaria* (*Hexactiniæ*) toward which he has been working for some time, the fundamental features of which are different from those hitherto accepted. In their systematic studies the earlier actinologists had to content themselves mainly with external characters. Gosse's "British Sea-Anemones" and Andres' "Le Attinie" are classic examples of this type. After the introduction by the brothers Hertwig (1879, 1882), about twenty years ago, of anatomical and histological methods of study, in which they were followed by Haddon, McMurrich, and others, the classification of the *Actiniaria* was founded upon the combination of external and anatomical characters. Among the former were included the arrangement and number of the tentacles, the nature of the column-wall, etc., and among the anatomical characters the arrangement of the mesenteries, the musculature, and the gonads. Carlgren now goes still deeper and, for the primary subdivisions, subordinates these more obvious features to histological details, the principal of which is the presence or absence of a longitudinal ectodermal musculature on the column-wall. With this appears to be often associated the presence of a columnar ectodermal nerve layer, the absence of a basilar muscle, and a weak parieto-basilar; likewise the absence of the Flimmerstreifen or ciliated streaks from the mesenterial filament, and the gonidial grooves from the stomodæum. Taxonomic studies of the *Actiniæ* may thus be said to have passed through three phases in the endeavor to secure a morphological and phylogenetic system.

Undoubtedly the best arrangement would be one in which the results from al three sources were combined, but it is doubtful if more than an approximation to this is possible, divergences having taken place along many different lines, often in the same species. Hence the great difference of results according as one or another feature is accorded special prominence in systematic studies.

Carlgren commences with the supposition that the earliest *Actiniæ* were free and possessed of a well-developed ectodermal musculature and ganglion layer[1] throughout the body-wall and stomodæum, and the column-wall, tentacles, and disk were much alike in structure. The internal musculature was very weak or absent, and the mesenterial filaments possessed only a single median lobe. The Flimmerstreifen or ciliated streaks and gonidial grooves were absent. With the assumption of a sedentary habit the external musculature diminished in importance, the internal basilar, sphincter, and mesenterial muscles increasing, while the ciliated bands and gonidial grooves appeared to strengthen the internal circulation. In some polyps the original ectodermal columnar musculature persists, while in others it has become altogether lost, though it remains in the tentacles and disk. Wherever the ectodermal musculature is persistent in the column-wall Carlgren would consider its possessor as a primitive type and, however divergent the species may have become in other directions, would classify it along with polyps in which the same structure occurs.

The classification followed by Carlgren in his "Ostafrikanische Actinien," with the principal characters in each subdivision of the *Actiniaria*, is as follows:

I. CERIANTHARIA.

II. ACTINIARIA.

A. Tribe *Protantheæ*. Actiniaria with a longitudinal musculature and ganglion layer in the column-wall and usually in the stomodæum; basilar muscle absent; filaments usually without ciliated streak; without acontia, marginal spherules, and cinclides; sphincter muscle either absent or very weak, and always endodermal.
  1. Subtribe *Protactininæ*. Protantheæ with only one tentacle in each radial chamber.
  2. Subtribe *Protostichodactylinæ*. Protantheæ with more than one tentacle in some of the radial chambers.

B. Tribe *Nynantheæ*. Actiniaria in which the column-wall and usually the stomodæum are devoid of a longitudinal musculature and ganglion layer. Basilar muscle and ciliated streaks usually present.
  1. Subtribe *Actininæ*. Nynantheæ with the tentacles arranged in alternating cycles, not in radial series. Each radial chamber with only one tentacle.
  2. Subtribe *Stichodactylinæ*. Nynantheæ in which all or part of the tentacles are arranged in radial rows or groups; all or part of the radial chambers bear more than one tentacle.

III. ZOANTHARIA.

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[1] Attention may be drawn to the strong development of the nervous layer which occurs at the aboral region in the larval, free-swimming stage of many anemones and corals. McMurrich (1891, p. 317) has described such in the larva of *Rhodactis sancti-thomæ*, and I have found a somewhat similar condition in the larva of *Lebrunia coralligens* (1899). Also in the larvæ of the Madreporarians *Favia fragum*, *Isophyllia dipsacea*, and *Agaricia agaricites* I have discovered a well-developed aboral nervous layer. Probably the formation represents part of an aboral sense-organ and disappears on fixation, the larvæ settling by that extremity. I am not prepared to say if it has any phylogenetic significance. No ectodermal muscle fibers have been distinguished in the larvæ, though on Carlgren's assumption they may be expected to occur.

The *Protantheæ* will thus include Actinians which have retained their primitive histological and anatomical structure, wholly irrespective of modification along other directions, while the *Nynantheæ* will embrace forms more highly developed as to their histology, anatomy, and external characteristics. Included under the former are representatives from each of the two great divisions, *Actininæ* and *Stichodactylinæ*.[1]

With the great progress which has been made in the morphological study of the *Zoantharia* (using the term in its usually accepted sense) within the last two decades, students of the group are in a better position than they formerly were for estimating which of the polypal characters are really of phylogenetic importance and should therefore be seized upon for the purpose of erecting a classification which will show their true relationships. Writers such as McMurrich (1898, page 229), Haddon (1898, page 411), and van Beneden (1897, page 153) are disposed to regard the ectodermal columnar musculature as ancestral, and the forms in which it occurs as the lowest members of their own particular group, but they are not prepared to accord to it the importance of making it the one character upon which the grouping should be determined, to the exclusion of later divergences. It is rather regarded as a character which, sporadically, as it were, may appear in any group, the various species possessing it not necessarily representing a homogeneous or natural assemblage.

No one doubts that the forms in which the columnar ectodermal muscle and nerve layers are associated with the absence of the basilar muscle, a weak parieto-basilar muscle, absence of the ciliated streak and gonidial grooves are more primitive than forms in which the muscle and nerve layers are absent, but it is doubtful as to how far their possessors represent a homogeneous group to be separated from others. To my mind they represent the most primitive members of various divergent groups, rather than a group to themselves. To separate them as a whole from others would be to neglect the facts of their subsequent development from the primitive type.

At the outset we are confronted with the fact that Actinians have evolved in complexity of structure along many different directions. In addition to that of the mesenterial plan there are divergences in the tentacular system, the musculature, the column-wall, as well as in many minor characters. Following Carlgren's proposals, Actinians which retain certain primary characteristics will be grouped together, however divergent they may have otherwise become. Carlgren replies that structures such as evaginations of the column-wall (*Aliciidæ*,[1] *Bunodosoma*, 1900*a*, pp. 13, 28), and a strong constricted sphincter muscle (e. g., *Stoichactis*, *Actinoporus*, p. 118) may appear in any group, and that their occurrence does not necessarily imply any relationship in the forms possessing them. Undoubtedly this is in the main correct when isolated structures only are considered, but the classifications hitherto have been founded more upon a combination of features, and the greater the number which can be shown to agree the more likely are the forms to be closely related. Just as isolated characteristics may denote no natural relationships between their possessors, so certain primary characteristics may be retained by different species whose other features show them to be widely separated. It is really a question of determining which characters are homoplastic and which are homogenetic.

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[1] In connection with the structural variation exhibited by the *Actiniaria* a comparison with the polyps of the closely allied *Madreporaria* is instructive. So far as I have observed in the course of an examination of the soft tissues of over twenty species of West Indian corals there are no certain indications of a columnar ectodermal musculature and ganglion layer, though such occur in the tentacles and disk. True gonidial grooves are always absent from the stomodæum. The mesenterial filaments are invariably formed of only a single median lobe, no lateral lobes with ciliated bands being developed. The internal musculature is everywhere very weak, and the sphincter remains endodermal; mesoglœal plaitings are rarely formed for the support of the parieto-basilar muscles, and basilar muscles are absent. Marginal spherules and cinclides have not been met with; mesenterial filaments are freely extruded through any part of the column-wall and disk, but at no part of their course are they independent of mesenterial attachment, and hence are not true acontia. The *Madreporaria* are therefore at practically the same phylogenetic level as the *Actiniaria* which Carlgren includes within the *Protantheæ*, except as regards the apparent absence of the columnar ectodermal musculature and ganglion layer.

By adopting the course proposed by Carlgren it is evident that a duplication of groups within the two sections, *Protantheæ* and *Nynantheæ*, must arise. Within the *Protantheæ* may be species which have evolved in practically all directions known to actinologists, and also in the section in which the ectodermal musculature is lost will be forms modified along exactly similar lines. This is at once evident in the necessity for the subdivision of the hitherto sharply defined *Stichodactylinæ*. Tentacular disposition becomes subordinated to histological details. Though most students would probably admit that the old tribe *Stichodactylinæ* includes polyphyletic groups, yet to remove its simplest members seems to render impossible any natural arrangement.

I am also of opinion that once its importance is fully recognized, the ectodermal columnar musculature will be found in forms in which it has hitherto been overlooked. Except where maceration of fresh material can be resorted to it will be difficult to determine with certainty its presence or absence. Thus in sections of the column-wall of *Corynactis*, *Actinotryx*, *Actinoporus*, and *Phymanthus*, I have described appearances which would generally be assumed to indicate a weak muscle layer, but which, according to Carlgren, may be only the swollen ends of the supporting cells. I have not since had the opportunity of proving by means of maceration of fresh tissues whether the appearances described are actually referable to the presence of muscle fibrils or not, but considering the importance which is now attached to the question, and the possibility of the appearances being otherwise explained, I have in the present paper refrained from further reference to the genera in this connection.

Until the extent of the occurrence of the columnar ectodermal musculature and its association with other features have been more fully ascertained, it seems to me hazardous to break up, on its account, long-established systems of classification. Where forms have developed along similar lines from some ancestor it is more logical that they should be associated than that species should be kept together merely because they retain one or more ancestral characters. The combination of characters, both primitive and evolved, should be taken into account; the selection of only one would give an artificial character to any group.

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[1] The family *Aliciidæ* is characterized by a weak musculature and the column possessing simple or complex hollow evaginations. The genus *Bunodeopsis*, in which I first ascertained (1897) the presence of an ectodermal columnar musculature, will, according to Carlgren, have to be removed to the *Protantheæ* along with another representative, *Thaumactis*. In my description of the two species of the genus *Bunodeopsis* I had not realized the importance which this character has now assumed, nor of the other features associated with it, and therefore the account is incomplete in several essential details. The columnar ectodermal musculature in *Bunodeopsis* is strongly developed on delicate mesoglœal plaitings, and the nerve layer is also very clearly indicated. The stomodæal ectoderm likewise displays a muscular and nervous layer. No gonidial grooves occur and the internal musculature is very weak, the sphincter being of the diffuse endodermal type. The parieto-basilar is very feeble, and basilar muscles are absent, but a well-developed tentacular sphincter is present. Associated with these, however, are ciliated streaks on trilobed mesenterial filaments.

Thus the genus agrees in the main with Carlgren's definition of the tribe *Protantheæ*.

LIST OF SPECIES.

Ceriantharia.
Family *Cerianthidæ*.
Cerianthus, sp.?
Zoantharia.
Family *Zoanthidæ*.
Subfamily *Brachycneminæ*.
Zoanthus pulchellus (Duchassaing & Michelotti).
Zoanthus sociatus Lesueur.
Isaurus duchassaingi (Andres).
Protopalythoa variabilis (Duerden).
Palythoa caribæa (Duchassaing & Michelotti).
Actiniaria.
Order Actininæ.
Family *Phyllactidæ*.
Asteractis expansa Duerden.

Actiniaria—Continued.
Order Actininæ—Continued.
Family *Bunodactidæ*.
Bunodosoma granulifera (Lesueur).
Bunodosoma sphærulata, n. sp.
Family *Sagartidæ*.
Subfamily *Aiptasinæ*.
Aiptasia annulata (Lesueur).
Subfamily *Metridinæ*.
Calliactis tricolor (Lesueur).
Order Stichodactylinæ.
Suborder Homodactylinæ.
Family *Stoichactidæ*.
Stoichactis helianthus (Ellis).
Suborder Heterodactylinæ.
Family *Phymanthidæ*.
Phymanthus crucifer (Lesueur).

LIST OF SPECIES ARRANGED ACCORDING TO LOCALITIES.

Mayagüez Harbor.—*Calliactis tricolor* (Les.); *Zoanthus sociatus* (Les.); *Zoanthus pulchellus* (Duch. & Mich.).

Aguadilla.—*Bunodosoma granulifera* (Les.); *Zoanthus pulchellus* (Duch. & Mich.).

San Juan Harbor.—*Bunodosoma granulifera* (Les.).

Puerto Real.—*Asteractis expansa* (Duerd.).

Guanica Bay.—*Aiptasia annulata* (Les.); *Stoichactis helianthus* (Ell.); *Zoanthus sociatus* (Les.); *Cerianthus*, sp.?

Arroyo.—*Stoichactis helianthus* (Ell.); *Bunodosoma sphærulata*, n. sp.

Anoyo.—*Stoichactis helianthus* (Ell.).

Playa de Ponce Reef.—*Aiptasia annulata* (Les.); *Bunodosoma granulifera* (Les.); *Asteractis expansa* (Duerd.); *Phymanthus crucifer* (Les.); *Zoanthus pulchellus* (Duch. & Mich.); *Palythoa caribæa* Duch. & Mich.

Ensenada Honda, Culebra.—*Aiptasia annulata* (Les.); *Asteractis expansa* Duerd.; *Stoichactis helianthus* (Ell.); *Zoanthus sociatus* Les.

Fajardo.—*Stoichactis helianthus* (Ell.)

Hucares.—*Bunodosoma granulifera* (Les.); *Protopalythoa variabilis* (Duerd.); *Isaurus duchassaingi* (Andres).

CERIANTHARIA.

Family CERIANTHIDÆ Milne Edwards & Haime.

Genus CERIANTHUS Delle Chiaje.

Cerianthus sp. ?

Among the Porto Rican collections is a single specimen of a *Cerianthus*. The lower extremity is torn and the column is slit open for the greater part of its length. The length is now 6.5 cm. and the diameter 1 cm.; 38 tentacles occur in the outermost cycle and 35 in the inner. From the external characters alone I considered that the form might be the well-known *Cerianthus americanus* L. Agassiz, of the Carolina coasts. A comparison of its histology, however, with that briefly given by McMurrich

(1890) of *C. americanus* shows certain divergences, which make me hesitate in regarding it as this species. Without a thorough comparison of the two side by side it would be hazardous to establish the Porto Rican representative as a new species. I have since been endeavoring to secure specimens of the Carolina species for comparison, but so far without success. I therefore defer the description of the present specimen until its distinctness or otherwise can be established. Both McMurrich and H. V. Wilson have obtained at Nassau, Bahama Islands, larvæ of a *Cerianthus*, which may perhaps have been derived from polyps of the same species as the Porto Rican examples. I have never met with a *Cerianthus* around Jamaica.

ZOANTHARIA (restr.).

Zoantheæ, R. Hertwig, 1882; Haddon, 1891; etc.
Zoanthiniaria, van Beneden, 1897.
Zoantharia (restr.), Carlgren, 1900.

Actinozoa in which six primary mesenteries (protocnemes) arise bilaterally. The ventral or sulcar directives become complete, the dorsal or sulcular directives and the sulcar moiety of the protocnemic dorso-lateral pairs remain incomplete, while the sulcar moiety of the ventro-lateral pair is incomplete in one group (*Brachycneminæ*) and complete in another (*Macrocneminæ*). Additional mesenteries (metacnemes) arise independently (i. e. neither in pairs nor symmetrically on each side) within the exocœle on each side of the sulcar directives, and become arranged in unilateral pairs, constituted of an incomplete and a complete moiety.

Only the perfect mesenteries are fertile and bear mesenterial filaments with both glandular streaks and ciliated bands. A single sulcar gonidial groove is present. The ectoderm of the column-wall is devoid of a muscle and ganglion layer, and the mesoglœa is traversed by irregularly branching ectodermal canals or by scattered groups of cells. The body-wall is usually incrusted with foreign particles. The polyps are generally grouped in colonies connected by a cœnenchyme, the cœlenteron of each polyp communicating with that of the other members of the colony by means of basal endodermal canals.

I have already given the reasons for which the tribe *Zoantheæ* has been erected into an Anthozoan division equivalent to the Ceriantharia, Actiniaria, Alcyonaria, etc. It includes only one family, which therefore carries with it the definition of the order. It is of interest to note that though filaments do not occur on the imperfect mesenteries of adult Zoanthids yet McMurrich (1899) has found the glandular streak to be present on the V and VI developmental pairs in egg embryos, as well as indications of the filament in the micro-directives, all of which never reach the stomodæum.

The mesenterial arrangement characteristic of the *Zoantharia* (restr.) suggests in many ways the mesenterial sequence which must have been followed by the polyps which produced certain types of Palæozoic corals. The formation of the calcareous septa in corals is found to conform very closely with that of the mesenteries, both as to order of appearance and adult arrangement, just as do the tentacles. In the Palæozoic family *Zaphrentidæ* the septa are disposed pinnately with regard to two primary axial septa, the "main" and "counter" septa of palæontologists, and two other primary septa, the lateral or "alar" septa, can also be distinguished. If the mesenterial plan of the Zoanthid represented in fig. 2, plate A, be compared with the septal plan of a Zaphrentoid coral, such as *Streptelasma*, it will be seen how very closely the mesenterial spaces of the former correspond with the septal scheme in the latter. From the known relationships of the soft parts of a coral to the hard parts there is the greatest suggestiveness in the primary mesenterial plan of a Zoanthid to "main," "counter," and "alar" septa, while a pinnate addition of the later mesenteries is characteristic of the ventral aspect, which would correspond with the pinnate septa in the counter quadrant of the Zaphrentoid.

The septal plan of *Streptelasma* as given by Kunth, and in the palæontological text-books of Zittel and Nicholson, indicates that the mesenteries were added in the primary exocœlic chamber on each side of one of the pairs of directives, just as in the *Zoanthidæ*; but in the fossil coral another similar series of mesenteries appeared in the next primary exocœle on each side. In modern Zoanthids only two exocœlic regions of active growth persist beyond the protocnemic stage, but in the extinct Zaphrentoids there were four. The main, counter, and alar septa are the septa formed within the primary entocœlic chambers. Where mesenterial increase is simply bilateral at one region within an axial entocœle, as in *Porites* and *Cerianthus*, no principal axial septum would be produced, but such is provided for in polyps built upon the Zoanthid type.[1]

Family ZOANTHIDÆ Dana.

With definition of order.

Subfamily BRACHYCNEMINÆ Hadd. & Shackl.

Zoantharia in which the sulcar element of the protocnemic sulco-lateral pair of mesenteries is imperfect.

The above definition with regard to the sulcar element of the sulco-lateral pair being imperfect is not invariably true for all the individuals of a species. For in all the genera, except *Sphenopus*, included within the subfamily, polyps have been met with in which the mesentery referred to is perfect. In the paper on the Jamaican *Zoanthea* I have recorded that a specimen of *Gemmaria variablis* Duerden presented the normal brachycnemic arrangement on one side and the macrocnemic on the other. In a colony of *Palythoa mammillosa* Ellis & Solander, one polyp was brachycnemic on the right and macrocnemic on the left side; and in another polyp from the same colony the brachycnemic condition was on the left side and the macrocnemic on the right. Similar combinations of the microtype were found in *Palythoa caribaea* Duchassaing & Michelotti, but one polyp was altogether macrotypic on both sides, in place of the normal brachytype. In the course of the present investigations a polyp of *Zoanthus sociatus* was found which was brachycnemic on the left side and macrocnemic on the right (fig. 16); and Carlgren (1896, pl. VIII, fig. 6*a*) among other irregularities in a species of *Isaurus* found a polyp which was macrocnemic on the same side. Various other irregularities in the mesenterial arrangement of different species of Zoanthids have been given by other workers; but apparently very rarely is there an actual replacement of one type by the other, as in the cases above mentioned.

The numerous instances just cited are sufficient to indicate that the macrocnemic or brachycnemic type of mesenterial arrangement in the *Zoanthidæ* is not so fixed as has been supposed, that in the same polyp both types may occur on different sides, or even the entire macrocnemic arrangement may appear in place of the brachycnemic. Still, by far the majority of polyps of any species exhibit the normal order established by Hertwig, Erdmann, and others for the particular genus, and the exceptions now and again met with should not be allowed to diminish the taxonomic value of the two subfamilies. Of six polyps of the Porto Rican *Z. sociatus* examined, only the one represented by the transverse section in fig. 16 showed any departure from the established order, and the many Jamaican polyps examined were all normal.

Roule (1900) has recently suggested that the macrotypic genera *Epizoanthus* and *Parazoanthus* should disappear, and their representatives, along with those of *Gemmaria*, become united in the genus *Palythoa*. He goes so far as to place the *Gemmaria swiftii* of Duchassaing & Michelotti under the genus *Palythoa*, though I have shown (1898, p. 372) that its polyps, like those of all the species of *Parazoanthus*, are macrocnemic and possess a diffuse endodermal sphincter muscle.

Such associations as those proposed by Roule have reference mainly to the external appearance and habit of the colonies, and are wholly adverse to the principles of classification which hitherto have been found of the greatest value in Actinian studies.

Genus ZOANTHUS Lamarck.

Brachycnemic *Zoanthidæ*, with a double mesogloeal sphincter muscle. The body-wall is incrusted; the ectoderm is usually discontinuous; well-developed ectodermal canal system in the mesoglœa; monœcious or diœcious. Polyps connected by a thin lamellar cœnenchyme, stolons, or more rarely free.

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[1] Since this was written I have been able to show (Johns Hopkins University Circulars, vol. XXI, No. 155, January, 1902) from an examination of numerous serial sections that the primary septa of the Rugose coral, *Lophophyllum proliferum* (McChesney), are hexameral as in modern corals. Also that the later septa are added in such a manner as to leave no doubt that the mesenterial sequence bore the closest resemblance to that characteristic of living Zoanthids, except that in *Lophophyllum* new mesenteries and septa were added within four primary exocœlic chambers, whereas in Zoanthids new mesenteries arise in only two exocœlic chambers. Recent Zoanthids bear much the same relationship to the Palæozoic Rugose corals which living Actinians do to modern corals.

About a dozen different colonies belonging to the genus *Zoanthus* are contained in the Porto Rican collection. Externally they are divisible into two well-marked groups: (1) Colonies possessed of a continuous incrusting cœnosarc, from which small polyps rise as mammiform or cylindrical upgrowths, and are practically of the same diameter throughout. (2) Colonies without a continuous incrusting cœnosarc, the polyps forming irregular clusters, connected with one another and with foreign débris by narrow stolons, flattened cœnosarcal expansions, or growing directly from one another. In these the individual polyps are mostly club-shaped and pedunculated, but they may be cylindrical.

The representatives of the genus *Zoanthus* are very variable in form, dimensions, number of tentacles, and color, according to the conditions under which they are living, so that where an abundance of material is available it becomes very difficult to secure constant and specific characters, and thus to identify the different types with the descriptions of other workers.

Verrill in a recent paper (1900) recognizes ten West Indian species, including those from the Bahamas and Bermudas. Already many synonymic difficulties have been introduced. In my account of the Jamaican Actiniaria I have placed the colonies with a continuous incrusting cœnosarc under Duchassaing & Michelotti's term, *Mammillifera pulchellus*, a form which these authors believed to be but a variety of the *M. nymphex* of Lesueur. Externally they exhibit no differences from the Bahaman specimens which McMurrich has determined as *M. nymphex*, but the sphincter muscle of the two apparently differs to such a degree as to warrant their separation as distinct species. Transverse and longitudinal sections of the Porto Rican specimens of the Mammillifera type exhibit all the characteristics of the Jamaican specimens, and I have therefore determined them as *Zoanthus pulchellus*.

Verrill (1900, p. 566) in a footnote points out that Lesueur (1817, p. 178) was evidently in error in stating that the tentacles in *M. auricula* are 26 to 30; Lesueur's transverse section of the same species represents 61 mesenteries, and as the number of tentacles corresponds with the number of mesenteries it may be assumed that the former are about 52 to 60. As McMurrich distinguished his *M. nymphex* from *M. auricula* mainly on the tentacular differences it is clear that the determinations of McMurrich and myself become very difficult of comparison with the original types of *Z. auricula*, *Z. nymphex*, and *Z. pulchellus*, especially considering that the external characters upon which alone the three are founded are so very variable. I do not at present see that any advantage is to be gained by attempting to modify the synonymy already adopted, and therefore retain *Z. pulchellus* for the forms above mentioned. The characters as exhibited by the Jamaican and Porto Rican representatives seem clearly enough defined to enable them to be recognized at any time.

The Jamaica colonies with mostly clavate, pedunculated polyps, irregularly united by stolons, etc., I previously identified as the *Z. flos-marinus* of Duchassaing & Michelotti, mainly from the description which McMurrich gave of Bermudan specimens identified by him as this species. Verrill, however, has placed the *Z. flos-marinus* of McMurrich under his new species, *Z. proteus*, and the Jamaican *Z. flos-marinus* as a doubtful synonym of *Z. sociatus*. Judging from the figure of the sphincter of *Z. sociatus* which McMurrich (1898) has recently given I am inclined to think that Verrill's suggestion is the best solution of the present difficulty. There is nothing in Lesueur's description of *Z. sociatus*, nor in the more detailed study given by McMurrich, which does not occur in the specimens I have had under examination. I have therefore in the present paper placed the Jamaican *Z. flos-marinus* as a synonym of *Z. sociatus*, and identify the Porto Rican specimens as this species. The form possessing about 36 tentacles, which Duchassaing & Michelotti describe as *Z. flos-marinus*, has therefore yet to be rediscovered.

It is regrettable that Verrill has not given a figure of the sphincter muscle of his new species, *Z. proteus;* for among the external characters which he gives there are none which may not occur in the species already recognized. To my mind the validity of the new species can only be established by showing that the sphincter possesses a characteristic form, or that some other constant anatomical feature occurs.

Zoanthus pulchellus (Duchassaing & Michelotti). Pls. II, IV, Figs. 2, 3, 14.

Mamillifera pulchella, Duchassaing et Michelotti, 1866, p. 137, pl. VI, fig. 4 (an varietas *M. nymphææ?*).
Zoanthus puchellus, Duerden, 1898, p. 341, pl. VIIa, fig. 3; pl. XVIIIa, figs. 3, 4.

External characters.—The polyps are erect, cylindrical, short or elongated, thin-walled, smooth, usually closely arranged, and rise from a thin, tough, incrusting cœnenchyme. Where widely separated they generally appear on retraction as low mammiform prominences. On retraction they may be a little swollen above or remain of the same diameter throughout, and terminate distally in a rounded or slightly conical manner; a central aperture remains, from which radiate delicate capitular ridges. On partial retraction a deep groove is often seen dividing the capitulum into an inner and an outer part, but this becomes inturned when the column-wall is completely infolded.

The tentacles are short, digitiform, overhang during extension, and are arranged in two alternating rows of about thirty in each. The naked portion of the disk is depressed below the tentacular margin, smooth, thin-walled, and exhibits radiating lines. During expansion the oral cone is much elevated, and the mouth is slit-like. The stomodæal groove is not clearly seen in living polyps. The disk and capitulum become greatly enlarged during full expansion, so that when all the polyps in a colony are in this state their margins are in contact, and the mutual pressure produces a polygonal outline.

The cœnenchyme is smooth, continuous, lamellar, and adheres closely to the rocks and stones, following the various irregularities of their surface. Occasionally it becomes ribbon-shaped, when the polyps are more widely separated.

The color of the lower part of the elongated polyps is pale buff, the white mesenterial lines showing through the partly transparent walls; the upper part is olive blue, the capitulum being a little lighter and usually exhibiting green radiating lines. The tentacles are nearly always dark brown, but may be green or olive. The disk is generally a bright green, with lighter radiating lines; sometimes it is a pale green or yellow. A darker triangular area often extends from the two axial extremities of the mouth, and sometimes one is more pronounced than the other. The peristome in many is a bright pink, in others a bright green, more rarely yellow. The stomodæum sometimes appears green, with white radiating lines showing through. An olive-brown color is first extracted on immersing the colonies in alcohol, and the polyps become a uniform green, due to the presence of numerous zooxanthellæ within the endodermal cells.

The average diameter of the column in living specimens is 6 mm.; the diameter of the capitulum on full expansion varies from 8 to 10 mm. The length of the column is variable, depending mostly upon the position of the polyp in the colony. An average length is 5 mm.; some may attain a length of nearly three times this, while the mammiform polyps may extend only 3 to 4 mm. above the level of the cœnenchyme. The tentacles are from 2 to 3 mm. in length. Colonies are often met with from 20 to 30 cm. across.

Anatomy and Histology.—The column-wall is protected on the outside by a subcuticle, which is partly coated with a layer of foreign matter, mostly diatom frustules and fine mud. This is best seen in the lower part of the polyp, but may extend nearly the whole length. The ectoderm is very narrow, and its cells have lost their columnar character except in the distal region. Below, the layer is largely vacuolated, numerous nuclei occur, and the protoplasm is arranged in strands, and is granular and stains deeply. Connecting mesoglœal strands pass from the subcuticle to the middle layer, the ectoderm appearing as if embedded in irregular mesoglœal chambers. Toward the base the subcuticle is better developed and the ectoderm becomes thinner.

The mesoglœa is thickest in the region of the capitulum and also toward the cœnenchyme. It contains isolated connective-tissue cells, and fine processes are seen extending from the ectoderm to the endoderm. Cell-islets also occur, some of which contain dark, granular pigment matter. They are largest and most numerous toward the endodermal border, where they sometimes appear as forming an interrupted encircling sinus. Often a canal occurs opposite the insertion of each mesentery. Vacuoles, or circular spaces with only a single nucleus, are not infrequent in the mesoglœa toward its ectodermal border, and the margin is not always well defined.

The endoderm is a very narrow layer and is crowded with zooxanthellæ and small oval nematocysts. On its mesoglœal border it gives rise to a weak musculature.

The cœnenchyme contains numerous irregularly distributed canals connecting the cœlenteron of one polyp with that of others. These are lined with a strongly cilated endoderm, and possess a weak musculature.

The mesoglœal sphincter muscle is strongly developed and consists of a small upper or distal portion and a larger lower or proximal portion, the two separated by a deep groove in retracted polyps (fig. 14). The upper part consists of a number of small, closely arranged, rather elongated, irregular cavities, lined by muscle fibers. The mesoglœal spaces in the lower part of the sphincter are also very closely arranged, narrow, and at the broadest part extend nearly across the middle layer. Below, the muscle passes toward the ectodermal border and then turns inward, terminating in a number of small chambers toward the endodermal border of the mesoglœa.

Rather more chambers occur in the sphincter here represented than in the sphincter already figured in the account of the Jamaican polyps, and they are more closely arranged. Still the same general arrangement is presented in both; a certain amount of individual variation is to be expected.

The ectoderm of the tentacles is an ordinary columnar epithelium, and unlike that of the column-wall is devoid of any cuticle and subcuticle. Very small nematocysts occur in a peripheral zone, and a weak longitudinal musculature on its inner border. The mesoglœa is devoid of cell-islets, and the endoderm is greatly thickened in retracted examples, leaving scarcely any lumen and being crowded with zooxanthellæ. A weak circular endodermal muscle occurs.

The wall of the disk is much like that of the tentacles, but nematocysts are not so numerous in the ectoderm, and the endoderm is never so broad a layer. Numerous cells with granular protoplasm occur in the mesoglœa, especially toward its ectodermal border. Both the endodermal and ectodermal musculatures are very weak.

The stomodæum is usually greatly elongated in transverse sections, and the ectoderm forms about eight deep longitudinal folds on each side. The sulcar groove is smooth and elongated. Ciliated supporting cells are the principal constituents of the stomodæal ectoderm, but granular gland cells which stain deeply in methyl blue also occur, as well as a few nematocysts. The mesoglœa is rather broad, and contains a few isolated cells. The endoderm is very narrow, as is the case with the lining of the cœlenteron generally.

The mesenteries are microtypic in all the polyps examined, the number of pairs varying from 25 to 30. At their insertion in the column-wall they are narrow, but enlarge beyond, where the single basal canal occurs, the layer becoming very thin again. The basal canal is circular or oval in section in the upper region, but becomes more elongated below. A very weak parieto-basilar muscle occurs; the retractor muscle is clearly seen supported upon rounded folds of the mesoglœa and enables the paired character of the mesenteries to be established.

At the inner termination of the stomodæum the reflected ectoderm is very clearly seen, passing for a short distance up the face of the complete mesenteries and then downward along the free edge, giving rise to trifoliate mesenterial filaments. The character of the Zoanthid mesenterial filament has been fully described by McMurrich (1899), and it is unnecessary to repeat it here. Shortly below the stomodæal termination the mesenterial endoderm becomes greatly swollen, the mesentery appearing clavate in transverse section. The epithelium is densely crowded with granules of various kinds, many of them yellow. McMurrich has surmised that the granules are in some way products of digestion.

Many polyps from different colonies contained ova distributed about midway along the length of the macrocnemes.

Localities.—St. Thomas (Duchassaing & Michelotti); Jamaica (Duerden); Porto Rico (U. S. Fish Commission).

Zoanthus sociatus (Ellis). Pls. II, IV, V; Figs. 4, 15–22.

Actinia sociata, Ellis, 1767, p. 436, pl. XIX, figs. 1, 2; Ellis & Solander, 1786, p. 5, pl. I, figs. 1, 2.
Zoanthus sociatus, Lesueur, 1817, p. 176; McMurrich, 1889, p. 62, pl. II, fig. 3; pl. IV, figs. 15–18; 1898, p. 242, pl. III, fig. 1; Verrill, 1900, p. 561.
Zoanthus flos-marinus, Duerden, 1898, p. 339, pl. XVII *a*, fig. 2; XVIII *a*, fig. 2.

External characters.—The polyps are erect, clavate or cylindrical in form, and rise directly from a thin band-like incrusting cœnenchyme, or from a free irregular stolon, or directly from one another, either at the base or a short distance up the column. Usually the column is smooth, thin-walled, and pellucid, but sometimes a membranous cuticle occurs, more obvious toward the base, and foreign particles adhere to it. On complete retraction the column is usually swollen above, and on partial retraction a deep groove is seen separating the capitulum into an inner narrow zone and an outer region which passes insensibly into the column. Twenty-four to thirty minute rounded denticulations or capitular ridges, alternating with the outer row of tentacles, occur on the inner capitulum and are continued for some distance down the column.

The tentacles are dicyclic, slightly entacmæous, smooth, acuminate or rounded at the tip, and overhanging in full expansion. They vary in number from 48 to 60.

The disk is smooth, thin-walled, and shows radiating divisions. The peripheral area is more deeply grooved, and overhangs on full expansion; the middle region is elevated, and the mouth slit-like.

The cœnenchyme is very rarely band-like and incrusting; more often it is represented by stolons, variable in form and length, and constituting an irregular connection between the polyps. Sometimes the base of a polyp may be flattened or irregularly lobulated on one or more sides, as if forming cœnenchyme. Polyps all about the same size are often closely associated, incrusting some rock or stone. More often they are in practically free clusters, loosely attached to coral and shore débris, the polyps connected with one another in an irregular fashion by free, stolon-like cœnenchyme. Polyps living on the upper surface of stones are usually short and cylindrical, while those on the sides and underneath, or in crevices, become more elongated, with a distinct pedunole. In any large group of polyps the individuals on expansion rise to practically the same level however they are disposed with regard to one another basally.

The lower part of the column is usually sand-colored, the upper dark green or bluish; the tentacles are yellowish green, blue green, or brown. The disk presents various light and dark shades of blue and green, often mixed with yellow and black; the oral cone is bright yellow or green; a darker triangular area may be present at each angle of the mouth or at only one. McMurrich gives the column of the Bahaman specimens as usually flesh-colored, with the upper part purplish brown; the tentacles are the same in color as the upper part of the column.

The height of the polyps is very variable; an average may be about 17 mm.; the greatest diameter of the living retracted polyp is 5 mm., of preserved polyps 3 mm. The diameter of the disk in expansion varies from 5 to 8 mm.; the inner tentacles are 2.5 mm. long.

Anatomy and Histology.—The cuticle, subcuticle, and ectoderm are of the same character as in the previous species. The ectoderm is strongly vacuolated below, but less so above, and contains oval nematocysts; its mesoglœal boundary is often not well defined on account of the connecting mesoglœal strands, mesoglœal vacuoles, and cell-inclosures.

The mesoglœa is broad in the region of the lower sphincter muscle and thence narrows in both directions, becoming greatly constricted at the capitular groove. Large and small cell-inclosures occur, many of them containing fine pigment granules. Circular and oval vacuoles also occur, with but few cell contents. An interrupted encircling sinus is present, connected in places with the ectoderm. The endoderm is a very thin layer, loaded with zooxanthellæ, and forms a delicate circular musculature.

The sphincter muscle is double and mesoglœal; the smaller part consists of but a few distinct cavities, while the larger is very elongate and is represented by an enormous number of chambers variable in size and outline and becoming smaller below.

The ectoderm of the tentacles is devoid of cuticle and subcuticle, and contains numerous small oval nematocysts in its lower parts. Internally, fine pigment granules may occur and a weak ectodermal muscle on fine mesoglœal plaitings.

The mesoglœa is thin and finely plaited on its endodermal border for the support of the musculature. The endoderm is very broad in the retracted tentacles, leaving only a small lumen, and is crowded with zooxanthellæ.

The ectoderm of the disk is much narrower than that of the tentacles, and nematocysts are few. Between the ectoderm and mesoglœa appears a kind of intermediate layer in which are numerous oval granular cells with their long axis at right angles to that of the ectodermal columnar cells, some are partly free and partly embedded in the mesoglœa. The ectodermal and endodermal musculatures are weakly developed.

The stomodæum is usually oval in transverse section, with about six deep ridges on each side, less in number than the perfect mesenteries. The gonidial groove is rather wide, its ectodermal lining smooth, with few gland cells, and more strongly ciliated than the stomodæal ectoderm elsewhere. The rest of the ectoderm is broad and contains many small nematocysts in its deeper regions. A delicate nerve layer can be detected in favorable sections. The mesoglœa is also comparatively broad, more so than in the disk and mesenteries.

The mesenteries are normally brachytypic, but the macrotypic arrangement may occur on one side or another. The number of mesenteries is usually about 60.

The endoderm contains many zooxanthellæ and medium-sized oval nematocysts. The mesoglœa is finely plaited for the support of the retractor muscle. In most cases a basal canal occurs some little distance from the insertion of the mesenteries in the column-wall, but is not present in all. The canals contain many small oval nematocysts.

The reflected ectoderm and mesenterial filaments are of the usual Zoanthean character, and for this species have been fully described by McMurrich in his paper "The Mesenterial Filaments in *Zoanthus sociatus* (Ellis)," 1899. The endoderm becomes greatly swollen below, where it contains an enormous quantity of pigment and nutritive granules of various kinds. Before receiving Professor McMurrich's paper I had made numerous sections and drawings of the mesenterial filaments in this species, with a view to their study along somewhat similar lines to those followed in the above paper. My results as to the relationships of the intermediate tissues and ciliated bands, and also as to the very different character of the median part of the filament in its upper and lower regions, agree with those of McMurrich. I therefore merely give the figures and refer the reader to the latter's more detailed account. My studies on this and other species lead me to regard the uppermost part of the median filament as a downgrowth of the stomodæal ectoderm and the remaining part as endodermal, and, contrary to McMurrich, I am inclined to regard the intermediate streak as endoderm.

No fertile polyps have been met with.

Localities: Dominica (Ellis), Guadeloupe (Lesueur), Bahamas (McMurrich), Bermuda (Verrill), Jamaica (Duerden), Porto Rico (U. S. Fish Commission).

Genus ISAURUS Gray.

Large brachycnemic *Zoanthidæ*, with a single mesoglœal sphincter muscle. The body-wall is unincrusted; the ectoderm discontinuous; ectodermal and endodermal bays and small canals in the mesoglœa. Monœcious or diœcious. Polyps in small clusters or solitary.

Carlgren (1896) has carried out investigations upon several examples of an undescribed species of *Isaurus* in order to determine the relationship of the external smooth and tuberculated areas, occurring in all the species of the genus, with the internal bilaterality exhibited by the mesenteries and stomodæum. One would naturally expect that the external symmetry would correspond with the internal. Carlgren finds that, as a rule, the smooth concave part of the column corresponds with the dorsal side of the polyp, or side on which the pair of microdirective mesenteries is inserted (sulcular), and the convex part of the column, bearing the tubercles, corresponds with the ventral aspect of the polyp which bears the macrodirectives and the gonidial groove (sulcar). Although the tubercles may appear on both the right and left sides, it never happens that the smooth side is ventral; this belongs to the dorsal part of the body-wall.

The relationships met with in *I. duchassaingi* scarcely conform with Carlgren's results. In the specimen from which fig. 23 was taken a very large tubercle occurs a little distance from the middle of the dorsal side, and in varying sizes they extend nearly all round. A section of this kind, however, is unsatisfactory for showing the actual relationships of the smooth and tuberculated area. Very thick sections of two other polyps of the Porto Rican *Isaurus* were therefore taken and are represented in figs. 24, 25. Fig. 24 gives the appearance in one of the polyps, the mesenteries appearing much broader than in thin sections. The lightly shaded area represents the surface of the section, while the dark area beyond indicates the projections on the lower part of the segment. Fig. 25 represents the same details in the second polyp. In both, the narrow, smooth region of the polyp is wholly to the right side of the directive axis, but nearer the dorsal than the ventral border. The relationships were also checked on the entire polyp. It is clear from the figures that in none of the three polyps can the external bilaterality be said to correspond with the internal, as Carlgren found to be mostly the case with his specimens.

Isaurus duchassaingi (Andres). Pls. II, VI, VII, Fig. 5, 23–26.

Zoanthus tuberculatus, Duchassaing, 1850, p. 11; Duchassaing et Michelotti, 1860, p. 327, pl. VIII, fig. 5.
Antinedia tuberculata, Duchassaing et Michelotti, 1866, p. 136, pl. VI, figs. 2, 3.
Antinedia duchassaingi, Andres, 1883, p. 541.
Isaurus duchassaingi, McMurrich, 1896, p. 190, pl. XVII, figs. 6–8; Duerden, 1898, p. 346, pl. XVIIa, fig. 4, pl. XVIIIa, fig. 5.

Eight specimens of this peculiar Zoanthid were secured from Hucares, having evidently formed an isolated group in the same way that the species is found to occur around Jamaica and the Bahamas. In general the polyps, which are preserved in alcohol, are shorter and the transverse wrinklings and tubercles more pronounced than in forms obtained around Jamaica and preserved in formol. Still the same essential external characters are displayed; the constancy with which the overhanging bilateral form of the column, the vertical bilateral arrangement of the tubercles, and the peculiarities of the capitulum are repeated is a little remarkable. The polyps are rarely seen in an expanded condition.

One of the specimens sectionized longitudinally displayed the same histological and anatomical characters, including the form of the sphincter muscle, as have been already given by McMurrich and myself. Tangential sections through the ectoderm revealed very clearly the manner in which the layer is broken upon into distinct cubical blocks by mesoglœal partitions, extending from the subcuticula to the middle layer (fig. 26). The ectoderm cells in each block have lost their usual columnar form and become rounded, and are charged with zooxanthellæ and nematocysts; the endodermal bays are strongly developed, but not the ectodermal.

A polyp sectionized transversely revealed the normal microtypic arrangement of the mesenteries, with ten complete mesenteries on one side and nine on the other (fig. 23). The sulcar groove was not strongly defined, but the ectoderm was smooth, while along each side the stomodæal ridges were well pronounced. The mesenteries on the sulcar aspect were the first to become free. The section represented in figs. 23 passes through two of the tubercles of the wall; the one on the upper right hand is long and narrow, and the cœlenteron is prolonged into it. The ventral tubercle, though smaller, has a distinct bay-like character. The polyps represented in transverse section in figs. 24, 25 each possessed ten complete mesenteries on each side.

External characters.—The polyps are firmly adherent to rocks and stones by means of an expanded, irregular base. Although associated in groups they are only rarely found actually united with one another, the slight basal expansion representing all there is of a cœnenchyme. The column is cylindrical or clavate, greatly swollen toward the base, and overhangs, so as to present a concave and a convex border. The proximal part is smooth, with narrow, incomplete annuli, but the distal region bears rows of large, rounded or conical tubercles on the convex aspect, while the concave aspect is smooth, thus producing a marked external bilaterality. Four principal rows of from five to eight tubercles alternate with other rows which possess only two or three smaller protuberances. The column of young specimens may be wholly smooth. The disk is entirely hidden in retracted specimens, but the capitulum is flattened and simulates a disk. It forms the terminal truncated part of the retracted polyp, and is placed obliquely, a small central aperture remaining in the middle, from which radiate numerous ridges and furrows. Around the margin of the apparent disk occurs an incomplete ring of eight or nine tubercles, separated by deep depressions, and diminishing in size toward each extremity of the partial circle. In the living condition the column-wall is firm, tough, and partly transparent.

The basal cœnenchyme is colorless or irregularly greenish brown, apparently due to adhering algæ. The column may be dark granular brown, mottled with green and black.

The diameter of the column varies from about 2 cm. at the base to 0.6 cm. in the middle, where it is narrowest. Different polyps vary in height from 2.2 cm. to 4.2 cm. The retracted tentacles are 0.3 cm. long in section.

Anatomy and Histology.—The column-wall is provided nearly throughout with a thick subcuticle connected with the mesoglœa by strands across the ectoderm. The outside cuticle is practically devoid of adhering foreign matter. The ectodermal layer is broad, and its cells have lost their columnar character, the mesoglœal strands dividing it into cubical or spheroidal blocks, in which large thick-walled zooxanthellæ and nematocysts occur (fig. 26). The subcuticle disappears toward the upper extremity of the column, and the ectoderm then becomes continuous and columnar in character. The boundary between the ectoderm and mesoglœa is not clearly defined, portions of the former being, as it were, cut off and isolated within the mesoglœa as cell-inclosures or islets and becoming farther and farther removed inwardly.

The mesoglœa is very broad, and contains numerous cell-inclosures and uniformly distributed isolated cells with granular protoplasm. In the lower part of the column the cell-inclosures take the form of small communicating canals.

The endoderm is narrow and contains numerous zooxanthellæ and small nematocysts. A circular endodermal muscle occurs, and endodermal bays are met with at different levels, extending nearly as far as the ectoderm and evidently corresponding with the thin annuli noticed among the external characters. The tubercular projections on the upper part of the column are seen in sections to be formed mainly as thickenings of the mesoglœa, but the larger are hollow, their cavity communicating with the cœlenteron. Inturnings of the ectoderm may also occur, forming the ectodermal bays.

The sphincter is single, mesoglœal, and strong, extending nearly across the mesoglœa. Proximally the mesoglœal cavities are small and circular; distally they are oval and elongated.

The tentacles possess a peripheral zone of narrow nematocysts, among which are many gland cells. The mesoglœa is thin, but on its ectodermal border presents long, delicate, branching plaits for the support of the longitudinal muscle. The endoderm is narrow and contains zooxanthellæ of two kinds, large and small. The disk closely resembles the tentacles in structure, and also exhibits the peculiar ectodermal musculature.

The stomodæum may be strongly oval or nearly circular in outline, and the ectoderm is thrown into eight or nine folds on each side, corresponding with the mesenteries (figs. 23). The tube is but slightly truncated opposite the gonidial groove, the sulcar directive mesenteries extending from each corner.

The mesenteries are brachytypic; about ten pairs usually occur on each side. The perfect members are very narrow and arranged at equal distances apart all round the stomodæal wall. The mesenterial mesoglœa and endoderm are very thin, the latter crowded with zooxanthellæ and small oval nematocysts. The parieto-basilar and retractor muscles are clearly recognizable. Toward the insertion of the mesentery in the column-wall the mesoglœa is swollen and thrown into small, irregular plaits for additional support to the musculature. A basal canal and numerous other vertical canals and cell-inclosures occupy nearly the whole length of the mesentery. The reflected ectoderm is but feebly developed, and the mesenterial filaments are of the usual Zoanthean type. Toward the base of the polyp the mesenteries unite with one another and form a reticular structure, filling the whole of the cœlenteron.

No gonads have been met with in numerous specimens sectionized.

Localities.—Guadeloupe and St. Thomas (Duchassaing & Michelotti), Bahamas (McMurrich), Jamaica (Duerden), Porto Rico (U. S. Fish Commission).

Genus PROTOPALYTHOA Verrill.

Gemmaria, Duchassaing et Michelotti, 1860, p. 55; McMurrich, 1889, p. 131, etc.; Haddon, 1898, p. 639, etc.; Duerden, 1898, p. 350; Carlgren, 1900, p. 106.
Protopalythoa, Verrill, 1900, p. 562.

Brachycnemic *Zoantheæ*, with a single mesoglœal sphincter muscle. Solitary or connected by cœnosarc. The body-wall is incrusted. The ectoderm discontinuous or continuous. Lacunæ and cell-islets are found in the mesoglœa. Polyps diœcious or monœcious.

We owe to Professor Verrill (1900, p. 562) the recognition that Duchassaing & Michelotti's familiar name *Gemmaria* was preoccupied by McCready in 1859 in the Hydrozoa, and also to Verrill the substitution for *Gemmaria* of the term *Protopalythoa*. In doing this he has assigned as the type of the genus *Gemmaria variabilis*, a species described by me in 1898, and again referred to below. None of Duchassaing & Michelotti's species was regarded as sufficiently well known or recognizable to occupy this position.

Verrill (p. 563) comments upon the close relationship between the genera *Palythoa* and *Protopalythoa*, but wisely decides to keep them apart, a course which, for the time being, will tend to facilitate the study of their different representatives.

Under the name *Gemmaria* the genus has been defined in practically the same terms by all recent students of the *Zoantheæ*.

Protopalythoa variabilis (Duerden). Pls. II, VII, Figs. 6, 27.

Gemmaria variabilis, Duerden, 1898, p. 350, pl. XVIIa, fig. 5; pl. XVIIIa, figs. 7-9; von Heider, 1899, p. 130, pl. XVII, figs. 22-29.
Protopalythoa variabilis, Verrill, 1900, p. 562.

This species was first described from specimens obtained from Port Henderson, Jamaica, and von Heider (1899) has since provisionally identified as the same a form from the distant locality of Singapore. In the *Fish Hawk* collections from Hucares are fourteen specimens which are undoubtedly this species, and agree with the Jamaican representatives in the character suggested by the specific term, namely, the variability in size and outline of the polyps. Some are short and thickset, while others are long and slender. Mature polyps vary in length from 1 cm. to 2.5 cm.

Preserved in alcohol the polyps are now a dirty gray, due to the presence of dark incrusting particles. They are mostly free, as if torn from some other object, while a few are adherent to pebbles and shells, with a very limited development of cœnenchyme. Two or three small specimens rise directly from a broad base, as if grown from larvæ, but more likely from a separate fragment of cœnenchyme. All are in the retracted condition; the capitular region is swollen, and the capitular ridges, about thirty in number, are very distinct. On adding a few drops of acid to the liquid in which the polyps are placed a slight effervescence is set up, showing that some of the incrusting particles are calcareous; but in sections a large quantity of siliceous sand grains and a few sponge spicules and radiolarian tests remain, mainly limited to the outer half of body-wall. Not only is the greater part of the column-wall impregnated with foreign particles, but many are also found within the endoderm of the disk, although the two outer layers—ectoderm and mesoglœa—are here quite devoid of them.

Although charged to such a degree with sand grains and sponge spicules, it was possible to cut moderately thin sections from specimens embedded in paraffin. In vertical sections the sphincter muscle was found to be more strongly developed than in the polyp from which its form was originally represented (1889, pl. XVIII *a*, fig. 7), more nearly corresponding with that of *Gemmaria fusca* on the same plate. The sphincter muscle of the Porto Rican polyps is represented in fig. 27 to show the possible variation within the species. Transverse sections through a polyp displayed the microtypal arrangement of the mesenteries; seventeen complete mesenteries occur on one side of the dorso-ventral axis and fifteen on the other, while on each side of the sulcar directives three incomplete mesenteries are present in the region of active growth at the ventral aspect. Below are the more detailed characters of the species.

External characters.—The polyps are erect, firm, smooth, and rise independently from a lamellar cœnenchyme, or from around the base of one another, or rarely are solitary. They may be cylindrical in retraction, swollen a little above, or more usually are clavate. Preserved specimens are often transversely wrinkled. The capitulum usually presents about thirty capitular ridges and furrows. The tentacles are acuminate, arranged in two alternating rows of about thirty in each. The peristome may be considerably raised, and the mouth is elongated and slit-like. The disk and upper part of the column are greatly enlarged on expansion, and the margins of contiguous polyps come into contact and by mutual pressure produce a polygonal outline.

The cœnenchyme is thin and very sparingly developed. As a flattened band or ribbon it connects the different members of a colony, but individuals can be seen in process of separation, the cœnenchyme becoming constricted and ultimately breaking down.

The lower part of the column is light buff in color, while the upper part is dark brown. The tentacles are usually dark brown, but may be olive or green. The outer part of the disk may be dark brown with green radiating lines, and the peristome a bright green; or the disk may be green and the peristome brown; in others the whole of the disk is bright green. The stomodæum is colorless. In alcohol the brown color is first extracted, leaving the colony a uniform dark green; later, this gives place to a dirty buff color, due to the incrusting foreign particles.

The dimensions of the polyps vary greatly, even in the same colony. The length of the column of one of the largest polyps was 5 cm., diameter 1.2 cm; an average height is 1.5 cm. and diameter 0.7 cm. The diameter of the fully expanded disk is 2.3 cm.; the tentacles are about 0.3 cm. in length.

Anatomy and Histology.—The cuticle of the column-wall is thickly coated below with a layer of foreign material, principally diatoms. The ectoderm is continuous and presents irregular internal limitations, partly due to the occurrence of incrustations, but also as a result of the ectoderm passing insensibly into the cell-inclosures of the mesoglœa. Zooxanthellæ and large oval nematocysts occur. The incrustations consist mostly of sand grains, sponge spicules, and radiolarian tests, and extend from the inner border of the ectoderm beyond the middle of the mesoglœa. Sponge spicules are specially aggregated at the most distal part of the column (fig. 27). Von Heider (1899, pl. XVII, fig. 28) also represents a similar accumulation of spicules in the Singapore specimens.

The mesoglœa is thicker above and below than in the middle; numerous isolated cells and cell-inclosures occur, and among the cells of the latter are zooxanthellæ and oval nematocysts as in the ectodermal layer. Many small rounded or oval vacuolated spaces are present containing only a single nucleus.

The endoderm is of medium height and contains symbiotic algæ and pigment granules; the circular endodermal muscle is clearly recognizable.

The cœnenchyme contains numerous inclosures similar to those of the column-wall. Cœlenteric canals occur with a regular epithelial lining and a weak musculature.

The sphincter muscle is single and mesoglœal. It extends for a considerable distance down the column, situated a little nearer the endodermal border. The upper mesoglœal chambers toward its distal extremity are large, and a gradual diminution takes place toward the proximal end.

The tentacular ectoderm is broad, the periphery being crowded with small narrow nematocysts. The mesoglœa is thick in retracted tentacles, and contains isolated cells and foreign incrusting matter. Ectodermal and endodermal musculatures occur.

The discal ectoderm is also very broad and includes zooxanthellæ and glandular cells. The mesoglœa is nearly as broad as that of the tentacles, and contains cells with elongated processes and cell-inclosures, but no foreign matter. The endoderm is low and the cells contain zooxanthellæ. The layer may also be impregnated with foreign matter of the same character as that occurring in the column-wall.

The stomodæum is oval-shaped in transverse section, with a well-marked truncated gonidial groove, the sulcar directives extending from the corners. The ectoderm is thrown into vertical folds, 12 to 18 on each side. Large nematocysts and pigment granules are also present, and indications of a nerve layer. The cells are longer at the groove, and the mesoglœa thickens toward the same place.

The mesenteries are normally brachytypic, but occasionally the macrocnémic condition may occur on one side or the other. About thirty pairs of mesenteries are present, but the number may be either greater or less. Each mesentery contains a basal canal a little beyond the origin, and in the upper part other canals extend almost across the mesentery. In the complete mesenteries the canal is compressed, and more circular in the incomplete mesenteries. The cellular tissue in the canals contains zooxanthellæ and large oval nematocysts. Beyond the basal portion the mesenteries are very thin and the endoderm is provided with zooxanthellæ. The imperfect mesenteries are very short radially, appearing in transverse sections as goblet-shaped projections of the column-wall. The parieto-basilar muscle is well developed on both the perfect and imperfect mesenteries.

The reflected ectoderm and mesenterial filaments are of the usual Zoanthean type.

Both male and female gonads may occur within the same polyp, either separately or on the same mesentery.

Localities.—Jamaica (Duerden), Singapore (von Heider), Porto Rico (U. S. Fish Commission).

Genus PALYTHOA Lamouroux.

Brachycnemic *Zoanthida* with a single mesoglœal sphincter muscle. The body-wall is incrusted. The ectoderm is continuous. The mesoglœa contains numerous lacunæ, and occasionally canals. Diœcious, rarely hermaphrodite. Polyps immersed in a thick cœnenchyme, which forms a massive expansion.

Contrary to all other species previously examined a Javan *Palythoa* has been found by Carlgren (1 00*a*, p. 110) to be hermaphrodite.

In the paper on the Jamaican *Zoantheæ* I have already discussed the practical absence of reliable taxonomic characters for the species of this genus. The external features available—color, number of tentacles and capitular ridges, form of the colonies and individual polyps, extent of immersion within the cœnenchyme, and dimensions—seem of little assistance; while, judging from the number of species already described, not much help is likely to be forthcoming from the characteristics of their internal anatomy and histology, including the nature and distribution of the incrusting particles, the form of the sphincter muscle, the arrangement of the mesoglœal canal system, thickness of the cœnenchyme, and presence or absence of pigment granules. In none of these features has specific differentiation proceeded very far, and I consider it very doubtful whether the best course would not be to regard all the forms as but one species. Such a conclusion has been forced upon Professor Hickson (1898) as a result of his extensive studies of the Hydrozoan coral *Millepora*. He believes that all the numerous species of this well-defined genus already described are but variations in the manner of growth, and that no reliable specific differences are forthcoming when the colonies with their zooidal tissues are compared in detail. A similar study of the recognized species of the genus *Palythoa* will be only possible where colonies from widely separated regions are available for comparison.

Among the abundance of Jamaica material which has passed under my examination I have only determined what seem to be two distinct species, the differences being based mainly upon the number of capitular ridges, which corresponds with the number of tentacles and mesenteries. In one series of colonies practically all the polyps possessed from 14 to 16 capitular ridges, and in another series 18 to 20. Scarcely any other constant differences, however, were forthcoming.

Palythoa caribæa Duchassaing & Michelotti. Pls. II, VIII; Figs. 7, 28.

Palythoa caribæorum, Duchassaing et Michelotti, 1860, p. 329.
Palythoa caribæa, Duchassaing et Michelotti, 1866, p. 141, pl. VI, fig. 11; Duerden, 1898, p. 365, pl. XVII *a*, fig. 9, pl. XIX, figs. 5–7.

A single *Palythoa* colony of about thirty strongly retracted polyps was found in the Porto Rican collections from the light-house reef at Playa de Ponce. The external characters avail but little toward its determination, but a careful comparison of sections with the Jamaican specimens which I identify as *Palythoa caribæa* reveals no important distinctions, and as the mesenteries are seventeen I identify it with this species rather than with *P. mammillosa*.

External characters.—The polyps are smooth, rigid, cylindrical, closely associated, and arranged within the cœnenchyme in an irregular manner. Distally they are free from the cœnenchyme for a short distance, the free portion being rounded or conical in retraction. On very strong retraction the upper surface of a colony may be nearly flat. At the periphery of the colonies the outlines of the marginal polyps are clearly indicated, and new individuals arise both at the margin and between the previously existing polyps. The capitular ridges and furrows vary from 14 to 17.

The tentacles are dicyclic, smooth, pellucid, very short, acuminate, and slightly entacmæous, the inner row opposite the capitular ridges. They vary in number from 28 to 34.

The disk is circular, depressed during partial expansion and overhanging on full expansion, being cup-shaped or saucer-shaped according to degree of expansion. Peripherally it is thin, transparent and non-incrusted, with rounded ridges and furrows; the central part is dome-shaped, contains a few small incrusting particles, and bears the slit-like mouth at apex. The gonidial groove is not clearly seen.

In the living condition the polyps are a nearly uniform cream color, or sometimes brown; they appear white when the ectoderm is rubbed off. The stomodæal walls are white.

The length of the polyp, as also the thickness of the cœnenchyme, varies much, and may be anywhere from 0.3 to 1.8 cm., but is usually about 0.7 cm.; the diameter of the polyp in section is 0.35 cm. The diameter of the disk on full expansion is about 1 cm. and on retraction 0.4 cm.; the distance of the centers of contiguous polyps is 0.5 cm.; the tentacles are about 0.2 cm. long. Colonies vary in size from a few centimeters across to several hundred.

Anatomy and Histology.—The lower part of the column-wall is indistinguishable from the general cœnenchyme in which the polyps are embedded, but except in the most strongly retracted polyps a free columnar region occurs above. The ectoderm spreads as a uniform layer over the whole external surface and is readily rubbed off in living colonies. The layer is continuous, but is not distinctly limited on its mesoglœal aspect, appearing to pass insensibly into the cell-inclosures of the latter. It contains zooxanthellæ and narrow, elongated nematocysts, as well as a large oval form. The foreign incrusting material is limited to the deeper part of the ectoderm.

The mesoglœa is thick and densely crowded with calcareous sand grains; a few siliceous sponge spicules, radiolarians, and an occasional test of a foraminifera also occur. Isolated cells and large and small cell-islets are scattered throughout, the latter containing nematocysts and pigment granules.

The endoderm is uniformly narrow, except in the upper region where the mesenteries are closer, when it becomes broader. It contains much granular pigment matter and many zooxanthellæ, and a weak endodermal muscle is present.

The single sphincter muscle is contained within an elongated series of small mesoglœal cavities; proximally, they are situated close to the endodermal border, but become more central above, where the cavities are a little larger (fig. 28).

The tentacles possess a broad ectoderm crowded with long narrow nematocysts, zooxanthellæ, and pigment granules; the mesoglœa and endoderm are both thin. The ectodermal musculature is well developed on mesoglœal plaitings, but the endodermal is weak.

The discal wall is much like that of the tentacles, but incrustations occur toward the middle where the mesoglœa thickens.

In its transverse outline the stomodæum varies in different regions and in different polyps. In most examples it is pyriform, truncated toward the groove, and the ectoderm forms seven or eight vertical folds on each side, the gonidial groove occupying nearly one-third of the diameter. In other polyps the stomodæum may be nearly circular and devoid of folds. The ectoderm is strongly ciliated and loaded internally with yellow pigment granules.

The mesenteries present the normal brachycnemic arrangement in most cases, but irregularities may occur, as where a polyp may be macrocnemic on one side and brachycnemic on the other, while one polyp has been met with in which the former arrangement occurred on both sides. The number of pairs varies from about 14 to 17. The mesenterial mesoglœa is very narrow except toward the column-wall, where it enlarges and contains the basal canal and sinuses. These occupy almost the whole transverse width in the upper region of the mesenteries, but are more restricted below. The basal canals are well developed in both the perfect and imperfect mesenteries and, in addition to cells with granular protoplasm, contain many oval nematocysts and pigment particles; below they are connected with the sinuses in the cœnenchyme. The endoderm on the lower part of the mesenteries is enormously thickened and loaded with nutrient granules.

The reflected ectoderm and mesenterial filaments are of the typical Zoanthean character.

Spermaria occurred on the complete mesenteries of some of the polyps examined.

Localities.—St. Thomas (Duchassaing & Michelotti), Jamaica (Duerden), Cuba (U. S. Fish Commission).

ACTINIARIA (restr.).

Actinozoa in which six pairs of primary mesenteries (protocnemes) arise bilaterally, and usually all become complete. The two axial pairs constitute the directives, in which the retractor muscles are on the faces turned away from one another; the remaining four constitute unilateral pairs, two on each side of the polyp, in which the retractor muscles are on the faces turned toward each other. Additional mesenteries (metacnemes) arise as unilateral pairs within the six primary exocœles, either simultaneously or successively in a bilateral manner from one aspect of the polyp to the other, and usually constitute one or more alternating hexameral cycles beyond the primary; sometimes the hexameral plan is departed from. One or more tentacles may arise from each mesenterial chamber. The column-wall occasionally possesses an ectodermal muscle and ganglion layer. Two gonidial grooves usually occur. Parieto-basilar and basilar muscles are generally developed, and usually ciliated bands on trilobed mesenterial filaments. The polyps are solitary, never forming colonies, and no incrusting or continuous skeleton is produced.

Order ACTININÆ Milne-Edwards.

Actiniaria in which the tentacles are simple, and arranged in alternating cycles at the periphery of the disk. Only one tentacle communicates with each mesenterial chamber.

The orders *Actininæ* and *Stichodactylinæ* are here employed with their older significance, not in the manner adopted by Carlgren (1900*a*).

Family PHYLLACTIDÆ Andres.

Actiniaria with a smooth or partly verrucose column; tentacles simple, subulate, situated at some distance from the apparent discal margin; between the tentacles and margin are low tentacular structures or foliose areas. Sphincter muscle endodermal, more or less circumscribed, lying in the interval between the tentacles and the frondose or tentacular structures. Two or more orders of mesenteries perfect.

The family *Phyllactidæ* has been studied anatomically mainly by Professor McMurrich (1889, 1893). It embraces at least the following genera: *Phyllactis* M. Edw., *Oulactis* M. Edw., *Diplactis* McMur., *Cradactis* McMur., and *Asteractis* Verr. Haddon (1898, p. 437) includes the genus *Hoplophoria* of H. V. Wilson (1890), but I have shown (1899) that Wilson's species, *H. coralligens*, is a *Lebrunia* and must therefore be placed with this genus under the family *Dendromelidæ*. The West Indian *Hoplophoria* never exhibits anything corresponding with the extensile and variable capitulum which Haddon describes for his *H. cincta*.

Genus ASTERACTIS Verrill.

Asteractis, Verrill, 1869, p. 464; 1899, p. 45; Andres, 1883, p. 506; Haddon, 1898, p. 439.

Phyllactidæ in which the column is provided in its upper part with vertical rows of adhesive verrucæ; outside the tentacles the acrorhagi are enormously developed, appearing as a flat, ruffled collar, and each bears numerous small hollow papillæ or finger-like simple or complex outgrowths. Sphincter muscle circumscribed. Twelve or more pairs of perfect mesenteries.

Asteractis expansa Duerden. Pls. II, VIII, IX, Figs. 8, 29–33.

Asteractis, n. sp., Duerden, 1898 *a*, p. 455.
Asteractis expansa, McMurrich, 1898, p. 232.

This species is one of the most plentiful in the collections from Porto Rico, but all the specimens received are strongly retracted and infolded. It is undoubtedly the form which is to be obtained in such abundance all around the Jamaica coasts, and which has been discussed and partly described by McMurrich (1898, p. 232) from twenty-six specimens obtained by him from Cuba. On account of the uncertainty involved in its identification with others already described it is desirable that a full account of its characters should be given. I have therefore supplemented the study on the Porto Rican examples with other details obtainable from living Jamaica specimens. A discussion of its relationship with other species is given at the end of the description.

The usual living condition of the polyps is that of an exposed circular disk at the level of the sea-floor in very shallow water, the remainder of the animal being completely buried. The base may be fixed to rocks or stones, or merely adherent to loose fragments. When the polyp is only embedded in gravel and sand it can readily be secured by passing the fingers downward and around it and then lifting up the entire mass. When thus collected the whole of the upper part of the column is thickly coated with sand, fragments of shells, and small pebbles, held there by means of verrucæ. The foreign matter is slowly dropped if the column remains exposed in the laboratory for some time. Placed in a tumbler or vessel, the upper part of the column, along with the acrorhagi, overhangs gracefully, its form and the delicacy of the colors rendering the polyp a very attractive object. It was from such a specimen that fig. 8, pl. II, was taken.

In the laboratory the polyps exercise some selection in their food, anything objectionable being dropped over the edge as a result of the contractions of the latter. Should the water become stale the stomodæum is everted, and if no change is made in its surroundings the eversion of the polyp may become complete, enabling all the internal organs to be observed. The exposed colors vary with the nature of the sea-floor, the general impression being dark olive on a black muddy floor, and gray in coral mud or sandy surroundings.

External characters.—When the polyps are expanded in the laboratory, free from foreign material, the base is larger in diameter than the column and pellucid, the mesenterial lines showing through. The margin is crenate.

The column is erect and cylindrical, narrow in the middle, and broad below and above. It is thin-walled and divided by the mesenterial lines into well-marked rounded ridges and furrows, especially toward each extremity. Distally the column is caliciform and considerably overhangs the lower part. The verrucæ are circular and extend in longitudinal rows down the intermesenterial ridges for about one-third of the length of the column, each ridge possessing about a dozen. The members of any row are usually irregularly arranged with reference to the contiguous rows, but sometimes they are disposed in transverse cycles. The middle of the verruca is usually depressed, giving a sucker-like character to the whole organ.

The oral disk, regarding as such all the flat exposed part of the polyp, consists of three areas: (*a*) A peripheral zone, constituted of radiating, frondose bodies—the acrorhagi, in diameter occupying from one-half to two-thirds of the whole disk, and corresponding in number with the tentacles. (*b*) The tentaculate zone, containing four cycles of subulate tentacles. (*c*) The usual smooth naked area of the disk or peristome, with the mouth in the center.

The frondose areas are broad radiating bands, closely arranged, but sharply separated from one another by deep, naked grooves, mesenterial in position, and only seen on actually separating the ridges. They are raised a little above the general level of the disk, and are partly distinct from one another at the outer margin, where they overhang. They bear tubercles and irregular short outgrowths, some of which become minutely dendriform, and are provided with rounded tubercles and short finger-shaped processes. The outgrowths are a little closer and more numerous at and toward the sides and ends of the acrorhagi, and are sometimes almost absent along the middle. The complete zone consists of three cycles: (*a*) A primary series, twelve in number, extending practically as far as the base of the outermost cycle of tentacles, and occupying the same radii as the first and second cycles of tentacles; centrally, as well as at the margin, they may be produced so as to be partly free from the rest of the disk. (*b*) A secondary series, also twelve in number, extending centripetally a little more than half the length of the first, and corresponding with the third cycle of tentacles. (*c*) A tertiary series of twenty-four, opposite the fourth cycle of tentacles, generally narrower and shorter than the last, with the tubercular and frondose outgrowths not as well developed. In the living condition the individual outgrowths at the centripetal end of the second cycle occasionally become much enlarged, inflated, and lighter in color, adding a peculiar character to the disk. The number may vary at times, an arrangement in fourteen instead of twelve being counted in one polyp. In preserved polyps the disposition of the frondose areas in cycles is by no means so readily recognized as in the living condition.

Comparing the acrorhagi of *Asteractis* with those of a typical Bunodid, such as *B. granulifera*, it is found that the papillæ, tubercles, etc., occur on the upper aspect of the organs in the former, while in the latter they are restricted to the lower aspect, the upper surface being quite smooth. The acrorhagi of most Bunodids bear stinging cells, while these are absent from *Asteractis.*

The tentacles are short, entacmæous, acuminate, broad at the base and thence narrow rapidly, smooth, generally forty-eight in number, and arranged in four cycles according to the formula 6 6 12 24. The disk and tentacles may be completely infolded. The naked portion of the disk is flat, smooth, and occupies but a small proportion of the total apparent disk. The mouth is oval and the gonidial grooves are strongly marked. The stomodæum is capable of complete eversion, and under uncongenial circumstances the animal may even turn itself inside out.

The coloration varies much in different parts of the same polyp, and also in individual polyps. The base is pellucid and white. The column is generally cream-colored below, becoming a lighter or darker olive above; sometimes the lower part displays irregular thin patches of crimson or orange; the verrucæ usually exhibit white centers. The colors on the disk vary somewhat according to the nature of the ground. The most usual condition is a pale olive, with the frond tubercles opaque white or grayish. The fronds may also be a dark olive, green, brown, or blackish brown. The tentacles are usually lighter or darker shades of olive or brown, with a green or crimson iridescence; several oval patches of opaque white, each with a clear center, occur on the inner surface. The disk may be flecked in various ways with opaque white or cream, often with irregular patches of crimson or green, especially around the mouth.

The height of the column varies from 4 to 6 cm.; it may even reach as much as 8.2 cm. The diameter is likewise inconstant; on full expansion it is about 3 cm. in the middle. The length of the inner tentacles is 1.5 cm. The diameter of the whole disk is usually 6 or 7 cm.

Anatomy and Histology.—The column-wall is of only moderate thickness. The ectoderm is much folded in contracted specimens, and no ectodermal musculature is recognizable. The mesoglœa is narrow, and exhibits a fibrous appearance; abundant connective-tissue cells are scattered throughout. The endoderm is very deep, and where the mesenteries are closely arranged becomes triangular in transverse sections. Zooxanthellæ are abundant. The endodermal muscle is well developed on fine branching mesoglœal plaitings, which in retracted polyps are arranged somewhat in groups. A section through a verruca reveals that the mesoglœa is elevated on each side (fig. 33).

The acrorhagi with their dendriform and tubercular outgrowths are extremely thin-walled structures, without any peculiar histological modifications. The mesoglœa is scarcely distinguishable as a distinct layer, and the ectoderm is much thinner than elsewhere and devoid of nematoblasts. A slight endodermal muscle occurs.

The sphincter (pl. VIII, fig. 30) is a small but typical circumscribed endodermal muscle, such as is characteristic of the *Bunodactidæ*. As in that family, it occurs between the acrorhagi and the origin of the outer row of tentacles. It is oval in shape and subpedunculated, and the mesoglœal plaitings are narrow and much branched.

The ectoderm of the tentacles is a broad layer, usually much folded in preserved specimens; the nematocysts are small and arranged in a peripheral zone. The longitudinal ectodermal muscle is strongly developed, and a thin nerve layer can be distinguished toward the proximal extremity. The mesoglœa is narrow and thrown into long, narrow, slightly branching plaits on its ectodermal border, following the foldings of the ectoderm. The endoderm is loaded with zooxanthellæ and presents very irregular internal limitations.

The naked portion of the disk shows both the ectodermal and endodermal muscles strongly developed on mesoglœal processes. Stinging cells do not appear to be present in the ectoderm.

The ectoderm of the stomodæum is strongly ciliated throughout, and displays a broad zone of deeply staining, elongated nuclei, among which occur abundant glandular cells and long nematocysts. The two gonidial grooves, though clearly distinguished in the living animal, are not strongly marked off from the rest of the stomodæum histologically. They are prolonged as languettes for some distance below the lower boundary of the tube. The mesoglœa is not appreciably thickened at the grooves, and is very thin throughout.

Forty-eight pairs of mesenteries are present, two pairs of which are directives. All are perfect for the greater part of the length of the stomodæum, but all except the primary cycle become free before the termination of the stomodæum is reached, the third cycle becoming free in advance of the second (fig. 32). In a small polyp only twenty-four mesenteries were present, all of which were complete in the upper region. Below the stomodæum the mesenteries are arranged in well-defined cycles, with the formula 6 6 12 24. The retractor muscle is circumscribed, and strongly developed on long, narrow, branching mesoglœal plaitings. A well-developed pennon, bearing the parieto-basilar muscle, occurs on the other face; in the upper region it is situated near the origin of the mesentery, but its internal free edge becomes further removed from the periphery as the lower region is approached. The retractor muscle is equally developed on the twelve pairs of mesenteries constituting the first and second cycles, but is weaker on the members of the third and fourth cycles.

Mesenterial filaments occur on all the mesenteries below the stomodæal region, both the ciliated and glandular streaks being well developed.

In the half section of a polyp, represented in fig. 29, the mesentery is viewed on its ectocœlic face, and the parieto-basilar muscle is indicated, extending practically the whole length of the polyp. The mesoglœa supporting it presents a very distinct free edge. The basilar muscle is clearly seen, and is also represented in section in fig. 31. Both inner and outer stomata occur, the former large and the latter exceptionally small and situated some distance from the periphery. In some mesenteries the outer stoma was not represented, while in others a thinning of the mesentery was recognizable where the aperture should occur, but the actual perforation had not taken place. Appellöf (1900, p. 77) has recently shown that, contrary to the generally accepted opinion, the mesenterial stomata originate in the embryo by resorption of the mesenterial tissue. It was maintained by the Hertwigs that they represent interruptions in the growth of the mesentery which had never been completed. Appellöf found in *Urticina* that at first the mesenteries are entire, and that it is only later that the perforations appear, first by resorption of the mesoglœa and then of the endoderm, the outer stomata appearing somewhat earlier than the inner.

In *Asteractis* it would seem that the outer stomata are in process of disappearing, or rather of ceasing to appear. Whenever present they are exceptionally small, while the large size of the mesenteries has enabled me to satisfy myself that in some cases they are altogether wanting. Where a thin, non-perforated spot occurs it is evident that the absorption of the mesenterial tissue is only partial. The incomplete development of the apertures may perhaps be associated with the exceptional width of the mesentery in this region, dependent upon the extraordinary development of the acrorhagi.

In one polyp sectionized male gonads were met with in great abundance, occupying a large proportion of the cœlenteron. The spermaria were arranged in roughly parallel rows, but on account of their crowded condition the cycle or cycles of mesenteries on which they were borne could not be determined.

Asteractis expansa is apparently one of the most plentiful of the Actinians within the West Indian area. This is certainly the case as regards Jamaica. Its abundance in the U. S. Fish Commission's collections would indicate the same for Porto Rico, while, according to McMurrich (1898, p. 233), it would seem to be fairly common on the Cuban coast. Like Professor McMurrich, in the paper just referred to, I have always considered this fact as strongly suggestive of its identity with one or other of the species established by the earlier actinologists. It can scarcely be expected that a form so abundantly represented around three of the islands of the Greater Antilles would be absent from the Lesser Antilles, whence Lesueur and Duchassaing & Michelotti obtained their types.

But uncertainties arise when it is attempted to compare it step by step with the descriptions of these writers and with the determinations of them made by subsequent students. Of the species to be considered are *Asteractis flosculifera* (Lesueur), *A. conquilega* (Duchassaing & Michelotti), *A. formosa* (Duchassaing & Michelotti), and *A. bradleyi* (Verrill). McMurrich (1889, p. 108) has described from the Bermudas, under the term *Oulactis fasciculata*, a Phyllactid which Verrill (1899, p. 45) regards as the *Actinia flosculifera* of Lesueur, and of which Verrill later gives a figure (1900, pl. LXVIII, fig. 1) under the title *Actinactis flosculifera*, the generic term being evidently a typographical error for *Asteractis*. Both Verrill and McMurrich have seen specimens of the Jamaica *Asteractis* and agree (*in litt.*) that it is quite different from the species referred to above.

The form which Duchassaing & Michelotti (1860, p. 46, pl. VII, figs. 7, 11) have described and figured as *Oulactis flosculifera* may perhaps be taken as referable to the present one, though their fig. 7 but indifferently represents the species when seen alive. A. Andres (1883) does not accept Duchassaing & Michelotti's identification of their form with the *A. flosculifera* of Lesueur, and separates *O. flosculifera* as a distinct species, *Oulactis foliosa*. McMurrich (1889, p. 56) described and figured as the *Oulactis flosculifera* of both Lesueur and of Duchassaing & Michelotti, and the *O. foliosa* of Andres, a single specimen which he found buried in the sand up to the tentacles on the shore of the island of New Providence, Bahamas. He described it thus: "The fronds, situated on the periphery of the disc, are in a single cycle, one surmounting each longitudinal row of verrucæ, there being altogether apparently 24." McMurrich (1898, p. 232) has since had the advantage of studying numerous specimens from Cuba which he regards as without question representatives of the present species. His opinion therefore of the identity of the present form with the older species of *Phyllactidæ* is of special value. He remarks as follows:

"With none, however, does it seem to agree very closely, though it seems to come nearest to *O. flosculifera* of Duchassaing & Michelotti ('60). In my original description of *O. flosculifera* ('89) I took it for granted that Duchassaing & Michelotti's identification was correct. Andres ('83) thinks otherwise and has separated the form described by these authors from Lesueur's *O. flosculifera* and named it *O. foliosa*. Perhaps after all Andres may have been right; the form which I described from the Bahamas agrees fairly well as to coloration with Lesueur's form, while the present form seems to agree more closely with that of Duchassaing & Michelotti. However, the earlier descriptions are all too indefinite to make the identification certain and it will perhaps lessen the chances of confusion in the future to accept Mr. Duerden's separation of the present species under the specific name he has chosen."

The occurrence of only 24 frondose areas at once separates the species from *A. expansa*, for in this 48 are invariably present, except in cases of irregularity.

The description given by Duchassaing & Michelotti (1860, p. 47) of their *Oulactis formosa* is very incomplete, but the accompanying figures (pl. VII, figs. 4, 5), showing only 20 tentacles in a single cycle, suffice to show that it is widely separated from *A. expansa*.

The species seems to bear some resemblance to *Asteractis bradleyi* Verrill, from Panama, the type species of the genus (1899, p. 46), though evidently this is a smaller form. Verrill in his original description (1869, p. 465) refers to "twelve conspicuous, dark spots, about midway between the tentacles and margin, and corresponding with the primary tentacles," in the drawing accompanying the specimens transmitted to him, but is unable to account for them. In Jamaican examples I have occasionally met with a similar appearance and found it to be due to a local distension of the papillæ. It is not a constant feature of the individual. The papillæ may afterwards return to their normal condition, and no distinction between them and the others is then apparent.

In his original account Verrill notes that the frondose areas are of different radial extent, exactly as found in the Jamaican species, but in his later description (1899, p. 46) he makes no reference to this, and his figure does not suggest an ordinal disposition. Further, the papillæ appear to increase in size from within outward in *A. bradleyi*, though such is not the case in *A. expansa*.

So far, then, the species seems distinctly separated from any previously described, and it seems preferable to retain the position assumed in McMurrich's paper.

Family BUNODACTIDÆ Verrill.

Bunodidæ, Gosse, 1858, 1860; et al.
Bunodactidæ, Verrill, 1899, p. 42.

Actiniaria with a flat contractile base; column usually provided over the whole or greater part of its extent with vertical rows of adhesive verrucæ or vesicular outgrowths, often with a capitular cycle modified as acrorhagi, no cinclides and acontia. Sphincter muscle endodermal and circumscribed. Perfect mesenteries usually numerous and strongly muscular; all may be gonophoric.

The family *Bunodactidæ* corresponds with the family *Bunodidæ* of Gosse and subsequent authors. The change of name is due to the recognition by Verrill that Gosse's generic term *Bunodes* was already preoccupied (see below).

The family includes Actiniaria which are readily recognized by the verrucose or vesicular character of the column and the very pronounced circumscribed sphincter. The genus *Leiotealia* alone has a smooth column. Both the *Phyllactidæ* and *Aliciidæ* are closely related with the *Bunodactidæ*, and as intermediate forms are studied the three may have to be united. The *Phyllactidæ* are separated mainly by the enormous development of the acrorhagi, which become strongly tubercular or lobed on their upper aspect, and constitute a large proportion of the exposed disk of the polyp. The *Aliciidæ* bear vesicular, often pedunculated, columnar outgrowths, but the muscular development throughout is much less, the sphincter being either absent or diffuse in character, while acrorhagi are usually absent.

Genus BUNODOSOMA Verrill.

Bunodes (pars), Gosse, 1855, 1860.
Bunodosoma, Verrill, 1899, p. 44.

Bunodactidæ in which the column is provided with vertical rows of vesicular outgrowths, which may be all of the same size or alternately larger and smaller, and with a cycle of simple or complex acrorhagi. Tentacles polycyclic. Twelve or more pairs of perfect mesenteries.

In 1899 Professor Verrill, having discovered that Gosse's generic term *Bunodes* (1855) had been employed a year previously by Eichwald for a genus of Eurypteroids, proceeded to subdivide into different genera the species which had been included under the long-established name. For forms the verrucæ of which serve as adhesive suckers, and of which the British *Bunodes verrucosa* (*B. gemmacea*) is the type, he gives the name *Bunodactis*. Attaching supreme importance to the presence of only six pairs of perfect mesenteries, he erected the genus *Bunodella* for the *Aulactinia stelloides* of McMurrich (1889, p. 28), but in a later paper of the same series (1899, p. 146) he withdrew the genus, having found that in large Jamaican specimens the number of perfect mesenteries in the type species may reach twenty-four. For the *Actinia granulifera* of Lesueur, Verrill proposed the genus *Bunodosoma*, distinguishing it from *Bunodactis* by the fact that the verrucæ do not form adhesive suckers, but are vesicular, and that the upper or submarginal verrucæ are larger, and in mature specimens more or less lobulated. The two forms of verrucæ appear to me well worthy of generic separation; they differ both histologically and physiologically. The alteration in the typical generic name made it necessary to effect a corresponding change in the family name, and Verrill therefore altered this from *Bunodidæ* to *Bunodactidæ*.[1]

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[1] Professor McMurrich, in his report on certain Puget Sound Actinians (Annals N. Y. Acad. Sci., vol. XIV, pt. 1, July, 1901), received while the present paper was going through the press, discusses at some length the synonymy of the genera now under consideration. Following the strict laws of priority, McMurrich employs Ehrenberg's (1834) subgenus *Cribrina* for the genus *Bunodes* of Gosse. It is only possible here to tabulate his conclusions, which are as follows:

Cribrina, Ehr. = *Bunodes* Gosse, *Eractis* Verrill, *Bunodactis* Verrill, *Bunodella* Verrill.
Urticina, Ehr. = *Tealia* Gosse, possibly *Epigonactis* Verrill.
Anthopleura, Duch. & Mich. = *Aulactinia* Verrill, *Ægeon* Gosse, *Bunodosoma* Verrill.

Bunodosoma granulifera (Lesueur). Pls. II, IX, X, Figs. 9, 34, 35.

Actinia granulifera, Lesueur, 1817, p. 173.
Urticina lessoni, Duchassaing, 1850, p. 9.
Oulactis granulifera, Milne-Edwards, 1857, p. 293; Duchassaing et Michelotti, 1860, p. 46.
Cereus lessoni (*Urticina*). Duchassaing et Michelotti, 1860, p. 42, pl. VI, figs. 13, 14.
Anthopleura granulifera, Duchassaing et Michelotti, 1866, p. 126, pl. III, fig. 8.
Aulactinia granulifera, Andres, 1883, p. 438.
Bunodes tæniatus, McMurrich, 1889, p. 23, pl. I, fig. 4; pl. III, fig. 7.
Bunodes granulifera, Duerden, 1898, p. 454.
Bunodosoma granulifera, Verrill, 1899, p. 45.

This common West Indian Actinian is represented by numerous specimens in the Porto Rican collection, sometimes with the light and dark longitudinal columnar bands still recognizable. In most cases the upper part of the polyps has become infolded, due to the action of the strong sphincter muscle; in one instance the reverse process of eversion has partly taken place, displaying the tuberculate or papillose acrorhagi to great advantage.

External characters.—The base is flat, circular, adherent to rocks and stones, and is a little larger in diameter than the column. It is radiately grooved in correspondence with the internal mesenteries, and preserved specimens also show deep concentric grooves.

The column is cylindrical, usually a little higher than broad, and very distensible. The entire surface of the column is crowded with subspheroidal vesicles, so that the actual body-wall can be seen only during full distension, in which condition the upper part of the column becomes very thin and transparent. The vesicular outgrowths vary much in size, arrangement, and form under the different conditions of expansion and retraction of the polyp. They are approximately equal in size and thin-walled; on large polyps they are bifid or even trifid toward the apex, and the wall is there denser. Their regular disposition in vertical rows is usually only evident during full expansion; at other times they press closely one upon another, and so disturb the regularity. They constitute twenty-four alternate lighter and darker vertical bands or zones, the color distinction being usually apparent for the whole length of the column. In large examples these color bands are not always recognizable. The darker zones have usually five rows of verrucæ, and the lighter zones three, making 96 rows in all, the former being nearly double the width of the latter. On partial expansion of the polyp each row may appear as if double, and in large polyps 192 rows are actually present. The number of verrucal rows is less in very young specimens. The outgrowths are incapable of attaching foreign particles to the column.

The column is deeply crenate at the apex, the depressions corresponding with the internal mesenterial attachments. A large acrorhagus, alternating with the outermost row of tentacles, occurs at the top of each entocœlic mesenterial division, and corresponds with two vertical rows of verrucæ; a smaller acrorhagus alternates with each of the larger, and is exocœlic in position, the series corresponding with the outermost cycle of tentacles. The acrorhagi are thus 96 in all, but in young polyps the smaller series may not be obvious. The outer or lower aspect of each acrorhagus bears numerous small papillæ; the inner or upper surface is smooth; the apex of each is thick-walled, and in certain states of preservation stands out prominently as a rounded, opaque white spheroid. A deep fossa occurs between the inner base of the acrorhagi and the outermost cycle of tentacles. Lesueur (p. 176) mentions that the margin is "furnished with tubercles, which are surmounted with small white pedunculated warts."

The tentacles are entacmæous, shortly conical, and generally 96 in number, arranged according to the formula 6 6 12 24 48.

The disk is large, smooth, flat, and often overhangs on full expansion. The two gonidial grooves are strongly marked by their thickened lips, and the stomodæum is smooth and readily everted. The tentacles and disk can be completely hidden by the overfolding of the column-wall.

The base is yellowish gray in color, with thin, radiating red bands; the column-wall is more usually a brick red, becoming dark reddish brown above. The verrucæ are mostly of the same color, but the tips are opaque white, especially in the distal region. The twenty-four alternate lighter and darker vertical rows are not well marked in some polyps, but are very persistent in others, even after preservation for a long time in alcohol. The acrorhagi are nearly colorless toward the tips, while the tubercles are opaque white; the fossa between the acrorhagi and the base of the outermost cycle of the tentacles is often scarlet. The tentacles are yellowish gray, and nearly transparent on the outer surface; several opaque, yellow oval patches occur on the inner aspect, and also a vertical, elongated spindle-shaped patch of crimson. The disk exhibits thin, radiating scarlet lines; and yellowish bands, passing from around the mouth, surround the base of the tentacles. The peristome and upper part of the stomodæum are a bright scarlet.

The above is the coloration generally met with, but different examples of the species vary much, and some may be here noted. Usually the column is a bright red, but may be crimson, orange, brown, chocolate brown, or a grayish olive. This latter color, and the verrucæ in light and dark bands, most nearly corresponds with McMurrich's Bahaman specimen. In the larger examples the alternate larger and smaller acrorhagi are well distinguished by the contrast of their opaque white tubercles with the rest of the column. The verrucæ toward the top of the column are usually more opaque white than those below; toward the base they become more transparent, with one or two dark centers. The column-wall in any individual specimen appears to be of practically the same color throughout, the lighter and darker vertical zones depending mainly upon the intensity of the pigmentation of the apex of the verrucæ.

Twelve series of radiating colored bands, each made up of three parts, the middle one much the broadest, may extend from around the mouth to the first and second cycles of tentacles, then each passing between the tentacular bases forms a cream-colored area on the antero-lateral portion of the base of the alternating tentacles in the outermost cycles. Often a narrow band of crimson passes up the anterior face of the tentacles.

The length of the column is usually about 4.5 cm., but a polyp may elongate as much as 7 or 8 cm. The diameter is from 4 to 5 cm., or may be even 7.5 cm.; the length of the largest tentacles is 1.3 cm., the diameter 0.4 cm. The acrorhagi may extend 0.3 cm. beyond the margin.

Anatomy and Histology.—In vertical sections the base is folded to an extraordinary degree; the foldings usually include all the three layers, long processes of the mesoglœa accompanying the ectodermal folds. The ectoderm of the base is very deep, being constituted of long narrow cells—mainly gland cells, with fine granular contents. The mesoglœa and endoderm are very thin; a weak, circular endodermal muscle is present, and fine black pigment granules occur in the inner layer.

The column-wall seems also much folded in sections, the appearance being due mainly to the presence of the vesicular evaginations (fig. 34). These are all hollow, and arise from both the entocœlic and exocœlic chambers. The wall of the vesicles is thinner than that of the column generally, and a short canal connects the cavity of the vesicle with the cœlenteron, while the endodermal muscle is specially developed around the aperture (cp. Dixon's figure of *Bunodes thallia*, 1889, pl. IV, fig. 4). The ectoderm of the vesicles is high, and medium-sized nematocysts are abundant, mainly limited to the outer apical region; numerous unicellular gland cells are present laterally. The granular secretion is seen partially extruded from many of the cells. The mesoglœa of the column-wall is very variable in thickness.

Small dark-colored pigment granules occur abundantly in the endoderm of the vesicles, as well as in the other parts of the column-wall, and, indeed, throughout the endoderm of the polyp. I have not been able to distinguish any yellow cells in the endoderm of any part of the polyps, but McMurrich states that numbers are contained throughout the layer in his Bahaman specimen. The endodermal muscle is very strongly developed along the column-wall, arranged on branching outgrowths of the mesoglœa.

The acrorhagi are much like the verrucæ in structure; nematocysts are abundant only at the tips of the tubercles, and the ectoderm is comparatively thin. No endodermal musculature can be recognized.

The sphincter muscle (pl. IX, fig. 34) is a typical circumscribed endodermal representative, situated within the fossa, and attached by only a very short pedicle. The appearance usually presented by transverse sections differs a little from that in the figure given by McMurrich, which is drawn associated with a mesentery.

In partial contraction the tentacles are fluted externally, and in transverse sections present a sinuous appearance similar to that described and figured by the brothers Dixon (1889, fig. 1) for *B. thallia*. The ectoderm is very broad, but the two other layers are narrow; the nematocysts in the former are small and slightly curved. The ectodermal muscle is arranged on dendriform mesoglœal plaitings, and is associated with a well-defined nerve layer (fig. 35). The endoderm contains many small pigment granules and forms a weak muscle.

The ectoderm of the disk contains few nematocysts, but numerous gland cells; both the endodermal and the ectodermal muscles are well developed, arranged on low mesoglœal plaitings. Large connective-tissue cells are distributed throughout the mesoglœa. The endodermal muscle is strong for some distance toward the mouth, but shows no marked concentration around the aperture, such as the Dixons found in *B. thallia*, and which they regarded as a second sphincter muscle, circumoral in position (1889, p. 322, pl. v, fig. 2).

The ectoderm of the stomodæum is thrown into numerous ridges and grooves, the former being followed by long delicate processes of the mesoglœa. The two gonidial grooves are not strongly distinguished histologically; attached to the directives, they extend for some distance below the rest of the stomodæum. Nematocysts are not plentiful in the stomodæal ectoderm, while large, deeply-staining gland cells are numerous. The nerve layer, separated from the mesoglœa, is clearly seen in places. The endoderm contains much granular matter.

Twenty-four pairs of mesenteries are present in small polyps, and forty-eight in larger. In the uppermost region they are all perfect; lower, only twelve pairs reach the stomodæum, and still lower only six pairs remain, of which two pairs are directives and are much shorter in transverse section than the laterals. The members of the three or four cycles alternate in the usual manner, and all bear mesenterial filaments as they become free from the stomodæum. The longitudinal retractor muscles are well developed, and circumscribed in character. The main portion of the muscle is in the middle of the width of the mesentery, but extends more than half-way across the face of the mesentery. It is very broad and arranged on fine branching mesoglœal plaitings. The transverse muscle on the opposite face is weak. Toward the insertion of the mesentery a slight enlargement of the mesoglœa occurs, and a pennon is often formed on the face opposite the retractor for the support of the moderately developed parieto-basilar muscle. The mesenterial endoderm is much vacuolated, and contains an abundance of fine black pigment particles.

Dissections and vertical sections through the pedal disk show a well-developed basilar muscle. The inner and outer stomata are both very small, especially the latter, which is represented by only a minute circular aperture some distance inward and below the upper extremity of the mesentery.

Both the ciliated and glandular streaks of the mesenterial filaments are well developed; the middle lobe bearing the glandular streak is often very narrow and greatly elongated.

Only one specimen, sectionized longitudinally, bore gonads. In his specimen McMurrich found all the mesenteries, with the exception of the directives, to be gonophoric.

This large and variously colored Bunodid has a wide distribution in the West Indies. Primarily described by Lesueur in clear terms, it was confused by Milne-Edwards with his genus *Oulactis*. Duchassaing & Michelotti first doubtfully accepted it as distinct from the *Urticina lessoni* described by the first of these two authors. Later they united the two as *Anthopleura granulifera*. Their figure in the second paper bears much more resemblance to the animal than the two given earlier. McMurrich found a single specimen of a Bunodid at Nassau, which, while noting that there seemed a good deal of probability that it might be simply a color variety of Lesueur's, *A. granulifera*, he preferred to regard as a distinct species, naming it *Bunodes tæniatus*. I have since forwarded examples and sections of the Jamaican representatives to Professor McMurrich, and he has concluded with me that they represent the same species as his Bahaman form, and therefore *B. tæniatus* becomes a synonym of *B. granulifera*.

The species is now known from the following localities: Martinique (Lesueur), Guadeloupe and St. Thomas (Duchassaing & Michelotti), in the bay westward of Nassau (McMurrich), Jamaica (Duerden), Porto Rico (U. S. Fish Commission).

Bunodosoma spherulata, n. sp. Pls. III, X, XI, Figs. 10, 36–40.

Among the collections from Porto Rico were two anemones which from the somewhat delicate character of their tissues and the presence of spheroidal outgrowths over nearly the whole of the column-wall suggested some species of *Cystiactis*, the most likely being the *Cystiactis eugenia* of Duchassaing & Michelotti (1866, p. 129, pl. vi, fig. 1). This surmise was strengthened by the fact that one of the specimens was attached to a free portion of a leaf of the marine phanerogam, *Thalassia* *marina*, and therefore might be capable of floating. *Bunodeopsis antilliensis*, with a similar habit, frees itself at times and floats with its basal disk upwards, and Duchassaing & Michelotti record the floating habit for *C. eugenia*.

Anatomical examination revealed a small, though very definite circumscribed endodermal muscle, and therefore the form could not be regarded as a *Cystiactis*, as that genus is now understood from an investigation of *C. tuberculosa* Quoy & Gaimard. Though strong, the sphincter in this latter has been found by Professor Haddon and myself (1896) to be endodermal and diffuse, and the genus has been placed in the family *Aliciidæ*. The possession of a circumscribed endodermal sphincter and of columnar evaginations marks the Porto Rican form as a member of the family *Bunodactidæ*.

Duchassaing & Michelotti give only the following description of *C. eugenia:* "Sp. parva, corpore tuberculis apice vesiculosis clavatis adoperto; tentaculis circiter 20 subaequalibus, translucidis, cylindricis, acutis, disco duplo et ultra longioribus ore conico exserto." Their figure (pl. VI, fig. 1) shows the vesicles to be somewhat cylindrical and spirally disposed. In the end I have concluded that the safest course will be to regard the present species as distinct from *C. eugenia*.

Viatrix globulifera is another long-looked-for West Indian species which has suggested itself, but it would undoubtedly be hazardous to compare this species possessing but a few spheroidal evaginations and tentacles with one in which the column is nearly covered with outgrowths and the tentacles are forty-eight in number.

In essential characters the new form differs very little from the genus *Bunodosoma* of Verrill, of which *B. granulifera* is the type, and may well be included under it. Verrill (p. 44) defines the genus as follows: "General form and appearance as in *Bunodactis*, but the hollow verrucae, arranged in vertical rows, are rounded or subconical and do not form adhesive suckers. Upper or submarginal ones are larger in the mature specimens, more or less lobulated, but have nearly the same structure as those below, though they are described as perforated when living. Tentacles numerous; many mesenteries, 12, 24, or more pairs being perfect. Sphincter muscle well developed, endodermal, and circumscribed." The only difference between the characteristics here given and those presented by the species now under investigation is in connection with the marginal evaginations. In the Porto Rican species they are simple, while in *Bunodosoma*, as understood by Verrill, they become more or less lobulated. In the present state of our knowledge of this group, such a detail does not seem worthy of generic recognition, and I have therefore modified the definition of the genus to this extent. Perhaps the uniformity in size of the columnar evaginations in *B. granulifera* and the alternations of large and small rows in the new species may, as further representatives are added, call for generic distinction.

External characters.—The base is flat and circular; preserved examples show radiating furrows, and the diameter is less than that of the column. In one specimen the base was adherent to a leaf of *Thalassia marina*.

The column is erect, cylindrical, thin-walled, and covered for the most part with vertical rows of nearly globular vesicles, which increase in size from below upward. At the apex of the column they terminate in a cycle of larger conical outgrowths—the acrorhagi. Both specimens are deeply constricted a short distance above the base, hence there is some uncertainty as to the character of the verrucæ in this region, but they appear to cease a little before the proximal termination of the column is reached. The vesicles are arranged in forty-eight rows, alternately large and small, a row corresponding with each mesenterial space, whether entocœle or exocœle. The twenty-four rows of smaller vesicles are opposite the twenty-four tentacles constituting the outermost cycle, while the rows of larger outgrowths, surmounted by the acrorhagi, alternate with the outermost tentacles. For the most part, the smaller vesicles alternate transversely with the larger, and all are so closely arranged that very little of the actual surface of the column remains exposed. The vesicles are simple, subspheroidal, sessile, hollow, and perfectly smooth, without any thickened areas which may represent special batteries of nematocysts. They are incapable of holding foreign particles to the column-wall. The acrorhagi are also simple and smooth, without any tubercular outgrowths or thickenings. A smooth, narrow fossa intervenes between the cycle of acrorhagi and the outermost cycle of tentacles.

The tentacles in preserved specimens are smooth, short, broad below and narrowing above, entacmæous, and closely arranged. They are forty-eight in number, twenty-four constituting the outermost cycle; the cyclic arrangement is therefore, 6 6 12 24.

The mouth is circular and widely open in the two specimens studied. The stomodæal walls are closely ridged and furrowed, and gonidial grooves are but weakly developed.

The specimens preserved in alcohol are now practically colorless; the tentacles, however, are slightly brown, due to the presence of brown pigment granules within the endodermal cells.

The height of the larger specimen is 1 cm., and of the shorter 0.4 cm. The diameter of the column of the former is 0.8 cm., and of the basal disk 0.5 cm. In all probability the dimensions of living specimens would be much larger.

Anatomy and Histology.—The basal disk possesses a very broad ectodermal layer, constituted of long narrow cells, many of which are peripherally charged with a yellowish granular secretion.

The column-wall is moderately thin throughout. The ectoderm is a broad epithelial layer; the mesoglœa nowhere becomes greatly thickened, while the endoderm everywhere is exceptionally low. The ectoderm consists mainly of glandular cells of two kinds—clear mucous gland cells and granular gland cells. The granular gland cells are so plentiful that it is very likely they give a certain degree of opacity to the tissues of the living polyp. Histologically the vesicular verrucæ differ in no important respect from the remainder of the column-wall, except that the ectoderm contains numbers of small nematocysts. The verrucæ are outgrowths from all the mesenterial chambers, the twenty-four rows of large vesicles being entocœlic and the smaller rows exocœlic in position. The acrorhagi are practically the same in structure as the other columnar outgrowths, but the ectoderm is a little higher than elsewhere and is abundantly charged with nematocysts, not, however, to such a degree as in the tentacles. The comparative fewness and small size of the nematocysts indicate that neither the vesicles nor the acrorhagi can be regarded as special batteries of nematocysts. In such organs the nematocysts are usually very large, thick-walled, and closely arranged.

The mesoglœa of the column-wall presents a slightly fibrous appearance and contains small, isolated, connective-tissue cells; its external and internal surfaces are smooth.

The endoderm throughout the polyp is remarkable for the shortness of its cells, these being scarcely half as long as the cells of the ectoderm, so that the layer everywhere is very narrow in section. Further, the cells are charged with brown or black pigment granules, which tend to obscure the other constituents. The granules evidently take the place of the symbiotic zooxanthellæ of other *Actiniæ*, for these are everywhere absent in the present species. In other examples of the *Bunodactidæ* a similar substitution seems to take place. Pigment granules occur in *Bunodosoma granulifera*, but zooxanthellæ are absent; in *Aulactinia stelloides* the conditions are reversed. Similar relations occur also among the *Sagartidæ*, but in some *Zoanthidæ*, such as *Palythoa*, both granules and zooxanthellæ occur in the same polyp.

The circular endodermal musculature is everywhere very feebly developed, except in the region between the outermost tentacles and acrorhagi, where it forms a characteristic circumscribed endodermal sphincter (fig. 36). Compared with that in many other *Bunodactidæ*, the sphincter muscle is rather feeble, but is remarkable on account of the very distinct peduncle which it possesses. In truly radial sections, away from the insertion of a mesentery, the muscle is, as it were, suspended from the inner surface of the wall of the polyp, but near the mesenteries it is displayed as a thickened ridge of the wall, and the mesentery may appear as if attached to it. The mesoglœal plaitings of the muscle are very numerous, and are disposed almost wholly on one side of the axis—not, as is usually the case, more or less pinnately on each side of the median axis.

The tentacles are of practically the same structure throughout their length. A uniform peripheral zone of long, narrow nematocysts extends from the origin to the apex. An ectodermal nerve layer is clearly shown, while the longitudinal muscle fibers are strongly developed on fine, subdendroid, mesoglœal plaitings, which are best seen in transverse sections. The tentacles being in the retracted condition, the mesoglœal layer is probably much thicker than would be the case in extended polyps. Here, as elsewhere in the polyp, the endoderm is a narrow layer with many pigment granules. In the tentacles the granules are often restricted to limited areas, other areas being wholly free from them; non-pigmented endoderm patches occur more plentifully toward the proximal extremity. Longitudinal sections of the tentacles display the ends of a weak, circular, endodermal muscle.

The stomodæum is wide and nearly circular in section, the ciliation being well preserved all round. The walls are thrown into numerous vertical ridges, which correspond somewhat with the internal attachment of the mesenteries, and are due to an increase in the thickness of the mesoglœa. The number of ridges, however, slightly exceeds that of the complete mesenteries, being from fourteen to sixteen on each side, while the mesenteries are only twelve on each side. The ridges become stronger in the lower region of the stomodæum, where many of the mesenteries have become free.

Gonidial grooves are only feebly indicated above, but are more strongly developed below. The walls at the opposite extremities are slightly depressed between the pairs of directives, the ciliation is a little stronger, and gland cells and nematoblasts are less numerous than elsewhere. The nuclei of the ectodermal supporting cells form a broad zone which stains very deeply; a nerve layer is also displayed, but no muscle fibrils. Many nematocysts and granular gland cells with yellowish contents occur, in addition to the supporting cells.

In serial transverse sections the stomodæum is seen to terminate first along its lateral walls, the two ends, with the directive mesenteries attached, being prolonged for some distance farther, independently of one another.

Twenty-four pairs of mesenteries, including two pairs of directives, are present in the polyp sectionized transversely. Twelve pairs, representing the first and second orders, are united with the stomodæum in the upper part of their course, and twelve alternating pairs, representing the third order, are free throughout and extend but a short distance from the column-wall. Of the twelve complete pairs, six alternating pairs—the second order—become free some distance before the lower termination of the stomodæum is reached; the remaining six pairs—the first order—extend practically all the way. Thus in the upper stomodæal region two cycles of mesenteries occur, twelve pairs in each, while in the lower region are three cycles, with the formula 6 6 12. The directives have the shortest transverse course of all the complete mesenteries.

The mesenteries are narrow and wide apart in the upper half of their course, but they become broader below, their free edge is greatly folded, and they more nearly fill the gastro-cœlomic cavity. The musculature is feebly developed above, but below the mesoglœal plaitings become stronger and mainly circumscribed in their arrangement (fig. 39). As the lower region of the polyp is approached a strong mesoglœal pennon, supporting the parieto-basilar muscle, is present on the face opposite the retractor muscle. The mesenterial mesoglœa increases much in thickness from above downward, and bears small stellate cells. Everywhere the endoderm is a very narrow layer, its cells being more or less charged with blackish pigment granules. The serial transverse sections indicate the presence of the inner mesenterial stomata on all the twelve pairs of perfect mesenteries, but I have not been able to establish an outer or parietal series. Basilar muscles occur, represented in fig. 37.

As already remarked, the six pairs of second-cycle mesenteries cease their connection with the stomodæum in advance of the first-cycle mesenteries, and some of the members of the latter cycle also become free slightly in advance of the others, while the directives continue their attachment over the greatest distance. The separation of the mesenteries from the stomodæum, as revealed by serial transverse sections, takes place in such an order as to suggest certain morphological considerations. The six pairs of second-cycle mesenteries do not become free simultaneously, but the pair on each side of what may be regarded as the ventral directives of the polyp are free in advance of the middle lateral second-cycle pairs; then the middle pair on each side become free, and finally the dorso-lateral pairs. The relationships are represented in fig. 40, taken from one of the sections. The ventro-lateral pairs are altogether free; the medio-lateral pairs are just becoming free, starting at the middle of the concave margin, and the dorso-lateral pairs as yet show no signs of separation. Thus, in the order of separation of the mesenterial pairs from the stomodæum, a regular succession from the ventral to the dorsal aspect of the polyp occurs, the process taking place simultaneously in the corresponding pairs on each side. Such a relationship may be taken to indicate that the mesenteries are older and further developed dorsally than ventrally.

The studies which have been carried out upon the development of the second cycle of mesenteries of the Actiniaria indicate that the order of appearance is paralleled by the above results obtained from serial transverse sections of probably a mature polyp. For, in general, it may be assumed that where a mesentery possesses diminished importance it represents a more recent development.

It is usually found, both in Actiniarian and Madreporarian polyps, that the second-cycle mesenteries are developed in unilateral pairs on each side of the polyp in a progressive manner, which may be either from the dorsal to the ventral aspect of the polyp, or vice versa. The fact that the dorsal mesenteries of the second cycle in *Bunodosoma* retain their connection with the stomodæum longer than the middle pairs, and these again than the ventral pairs, would indicate a progressive development of these pairs from the dorsal to the ventral aspect. The successive development of the pairs of second-cycle mesenteries from the ventral to the dorsal aspect of the polyp I have found to be characteristic of the buds of the coral *Cladocora arbuscula*, while in the development of larval polyps of *Siderastræa radians* the succession is from the dorsal to the ventral side.

The brothers G. F. and A. F. Dixon (1889, p. 322) first obtained evidence of the successive development followed by the members of the second cycle of mesenteries from freshly extruded larvæ of *Bunodes verrucosa*. Their series of sections from above downward first showed the dorso-lateral pairs on each side, then the middle pairs, and lastly the ventro-lateral pairs. The succession in growth was therefore from the dorsal to the ventral side.

At one region or another mesenterial filaments are present on all the mesenteries. On the members of the third cycle, which throughout their course are free from the stomodæum, the middle lobe first appears as a simple, more deeply-staining enlargement of the epithelium at the free end of the mesentery. But the lateral lobes make their appearance a little below, and the typical trilobed Actinian filament is then presented, the three lobes being very distinctly separated from one another (fig. 38). The four areas, which elsewhere (1900, p. 145) I have spoken of as the *glandular, ciliated, intermediate*, and *reticular streaks*, are well defined by their differences in histological detail, and do not require full description.

As the mesenteries of the second and first cycles cease their connection with the stomodæum they are tipped with filaments which, both in longitudinal and transverse sections, are shown to be continuous with the stomodæal ectoderm, the middle or glandular streak most nearly corresponding in histological detail. The strongly ciliated lateral lobes are limited to the region at which the mesenteries become free; below the stomodæum only the simple median lobe is retained (fig. 39), and this is the case also with the filaments of the third-cycle mesenteries. Where the filament is simple the mesenterial epithelium immediately behind becomes much swollen, as shown in fig. 39. The species is somewhat exceptional in the short course through which the lateral or ciliated streaks persist. In the lower region of the polyp the mesenteries are greatly contorted at their free edge, which is provided with the simple filament all the way.

No gonads were present in either of the specimens.

Family SAGARTIDÆ Gosse.

Actiniaria with a contractile pedal disk; body-wall smooth, or provided with verrucæ or tubercles, and usually perforated by cinclides, with or without a cuticle. Tentacles usually numerous and retractile, usually not very long, simple, and generally entacmæous. Sphincter muscle usually well developed and mesoglœal, occasionally diffuse endodermal, or even absent; at least six pairs of perfect mesenteries; the first cycle of six pairs of mesenteries may be fertile or sterile. Acontia present.

The above definition is mostly taken from Haddon (1898, p. 446), who in 1889 made one of the first anatomical studies of the group. In his latest paper he recognizes five subfamilies, as also does Carlgren: *Aiptasinæ, Sagartinæ, Phellinæ, Metridinæ, Chondractininæ*. The first and fourth have each a representative in the Porto Rican collection.

Subfamily AIPTASINÆ Simon.

Sagartidæ in which the sphincter muscle is either absent, or very feebly developed and mesoglœal, or diffuse and endodermal.

Genus AIPTASIA Gosse.

Aiptasia, Gosse, 1860, p. 151; Andres, 1883, p. 373; McMurrich, 1889, p. 6; Haddon, 1898, p. 447.
Bartholomea, Duchassaing et Michelotti, 1866, p. 133.

Aiptasinæ with an extensile soft body; column smooth, with cinclides arranged in from one to several horizontal rows around the middle of the column; no verrucæ or tubercles; tentacles numerous, long, smooth, or with thickened bands or tubercles, strongly entacmæous; sphincter muscle either absent or very feebly developed and mesoglœal, or diffuse and endodermal.

McMurrich (1889, p. 6) gives a full history of the genus, which is exceptional in the family *Sagartidæ* in that some of its members are entirely wanting a mesoglœal sphincter muscle, in consequence of which the disk and tentacles are never infolded. I have added the character of the tentacular wall to Haddon's definition of the genus.

McMurrich in 1896 (p. 182) described the *Heteractis lucida* of Duchassaing & Michelotti from specimens obtained from the Bahama Islands. The chief characteristic of the genus is the presence of tubercles upon the tentacles, and these are strongly marked in the West Indian representative. *H. lucida* is not uncommon in Jamaican waters, living under exactly similar conditions as *Aiptasia annulata*. When fully expanded the two are easily mistaken for one another, unless one is close enough to distinguish the character of the tentacular wall. The living polyps are found to be closely allied in such details as the peculiarities of coloration, the delicacy of the tissues, and inability to overfold on irritation. Internally the mesenterial musculature of *H. lucida* bears the closest resemblance to that of *A. tagetes* and *A. annulata*, and the other general characters of the three are found to agree. It is evidently best regarded as an *Aiptasia*, in which case the three Antillean species, *A. tagetes*, *A. annulata*, and *A. lucida*, present an interesting gradation in connection with their tentacles. The wall is smooth in the first mentioned, and nematocysts are distributed throughout; in the second the tentacles bear incomplete annuli, which are really thickenings due to the aggregation of large nematocysts; and in the third species the annuli have, as it were, become shortened up and form spheroidal tubercles. McMurrich found a feeble mesoglœal sphincter muscle in his specimens of *A. lucida*, but I can not discover such in the Jamaican polyps.

Aiptasia annulata (Lesueur). Pls. III, XI, XII, Figs. 11, 41–44.

Actinia annulata, Lesueur, 1817, p. 172.
Dysactis annulata, Milne-Edwards, 1857, p. 262.
Aiptasia annulata, Andres, 1883, p. 392; McMurrich, 1889, p. 7, pl. I, fig. 1; pl. III, fig. 1; Duerden, 1898a, p. 457; Verrill, 1900, p. 556; pl. XVIII, fig. 3.
Actinia solifera, Lesueur, 1817, p. 173.
Paractis ? solifera, Milne-Edwards, 1857, p. 249.
Paractis solifera (*Actinia*), Duchassaing et Michelotti, 1860, p. 39.
Bartholomea solifera, Duchassaing et Michelotti, 1866, p. 133, pl. VI, fig. 14.
Aiptasia solifera, Andres, 1883, p. 386.

Many specimens of this species were collected from Porto Rico, thirty or forty coming from Guanica Bay, so that it must be very abundant around the island. It is also common around Jamaica, and occurs in the more northern Bahamas and Bermudas. McMurrich has already given a full description of the Bahaman representative, but the specimens from Porto Rico and Jamaica present an important difference in the arrangement of the tentacles and mesenteries, to be referred to later. The description of the Porto Rican specimens given below is supplemented by notes on the living polyps as met with around Jamaica.

External characters.—In the living condition the base is flat and very firmly attached to various objects on the sea-floor. It is slightly larger in diameter than the column, and thin-walled, the lines of attachment of the mesenteries showing through. The column is erect, smooth, cylindrical, and capable of much extension and retraction. The internal mesenterial attachments show through as distinct white lines on the darker ground, and divide the column-wall into alternations of three narrow areas and a broader one; above, the mesenterial spaces are seen to be double those below. In preserved specimens, and this applies to all the Porto Rican examples, the column is deeply constricted a little below the apex, as in the figure of the species given by Duchassaing & Michelotti (1866, pl. VI, fig. 14), and as is recorded by McMurrich for *Aiptasia* sp. (1889a, p. 102). Verrill figures a specimen of the closely allied *A. tagetes* in this condition. The upper part of the column is altogether incapable of becoming overfolded on retraction of the polyp, so that the disk and tentacles are always visible.

Four or more horizontal cycles of oval cinclidal apertures, at the apex of white tubercles, occur about the middle of the column. The cycles are usually incomplete or broken, pores being missing here and there. The number of apertures in a vertical row, corresponding with one mesenterial chamber, usually ranges from one to five or six, but in a Bahaman example McMurrich found twelve. White acontia are emitted in abundance through the cinclides and also through the mouth. Distally the column becomes somewhat enlarged and passes directly into the tentacles, so that no definite columnar margin or fossa exists.

The tentacles are marginate, very numerous, and arranged in many hexamerous cycles; as many as 192, or even more, may be present. They are non-retractile and strongly entacmæous, the inner being usually long, as much as 5 or 6 cm. On full extension the walls are thin and nearly transparent, with numerous incomplete thickened spirals or rings, usually along the whole length. In some of the larger specimens the annuli on the inner cycles are few in number, the proximal portion of the tentacles being quite smooth. In preserved polyps the tentacular rings remain very evident as thickened bands. Microscopic examination proves that they represent special urticating areas. In all the examples of this species which McMurrich obtained at the Bahamas, the tentacles were arranged octamerously, the mesenteries likewise corresponding. In Jamaican specimens a hexamerous arrangement prevailed, both in the tentacles and mesenteries. There is no doubt, therefore, that the species varies in this important character, and an explanation is thus given to Lesueur's statement (1817, p. 172) that "the centre *tentacula* are about six or eight in number."

The naked portion of the disk is small; the peristome and lips are slightly crenulate, six ridges and grooves occurring on each side, corresponding with insertion of the mesenteries. The two stomodæal grooves are not distinctly shown. The lips often approach laterally, leaving an aperture at each end.

The base is white; the column is white or cream colored below, flecked with opaque white; above it is pale or dark brown and more strongly flecked. The tentacles are a granular brown; the numerous incomplete spirals or rings are gray or white with the internal brown granules showing through. The color of the innermost tentacles, when the annuli are almost absent, is a pale blue. The surface of the disk is dark brown; opaque white or brownish patches occur near the base of the innermost tentacles, and another series, corresponding with the tentacles, may be present around the mouth; the disk may also be flecked in other places with opaque bluish white.

At Port Antonio, Jamaica, a specimen was obtained nearly devoid of any brown color, the walls being perfectly transparent, or with only opaque white or cream flecks. The tentacular annulations in this example were not very perfect, the urticating areas being more in patches. Verrill describes the color of the Bermudan specimens as light green. The brown or green color is altogether endodermal in origin, and is due to the presence of numbers of zooxanthellæ within the cells of the endoderm. The white or cream opaque flecks are wholly superficial.

The column of large living specimens is 4 to 5 cm. in height; the diameter across the middle from 2 to 3 cm.; the inner tentacles are usually 4 to 5 cm. long; the outer 1 to 2 cm. Some polyps when fully expanded may be nearly double these amounts.

Anatomy and Histology.—The base is very thin-walled, the ectoderm being the broadest of the three layers. The latter is formed of long columnar cells, most of which have clear contents. The nuclei are mostly in a subperipheral zone, and the nerve layer is occasionally displayed. The mesoglœa is extremely narrow, and the endoderm is but a little thicker; many of the cells of the latter contain zooxanthellæ. A very weak basal endodermal musculature occurs.

The ectoderm of the column-wall in sections is thrown into deep folds as a result of contraction, the foldings being followed by long processes of the mesoglœa. Like those of the base, the ectoderm cells are largely glandular, and small nematocysts occur in places. A weak endodermal muscle, on slight mesoglœal plaitings, extends all the way from the base to the apex (fig. 42). It becomes a little stronger in the upper region, being best developed in the region corresponding with the external constrictions, that is, a short distance below the apex. In this position McMurrich found in *Aiptasia* sp.? (1889, p. 103) what he regarded as a second sphincter. Distally the endodermal musculature undergoes no increased development, such as can be regarded as a sphincter muscle.

Zooxanthellæ are abundant in the endoderm of the upper region, but less so below; hence the light color of the living polyp proximally, and the brown distally. McMurrich records a total absence of "yellow cells" in one of his specimens, and, as already mentioned, a colorless variety has been found around Jamaica.

A great difference is apparent in the walls of the tentacles according as the organs are retracted or fully extended. In the former state all the three layers are rather broad, the mesoglœa least so, and ectodermal and endodermal muscles are very evident on long processes of the mesoglœa. In the extended condition the wall is so thin that the three layers can scarcely be distinguished individually, except where the section passes through urticating areas. Here the ectoderm and endoderm are swollen, and nematocysts occur in the former, while the endoderm is crowded with zooxanthellæ (fig. 41). The nematocysts are of two kinds, large and small; the latter are arranged peripherally, and occur also in the intervening areas; the elongated examples extend wholly across the ectoderm and are restricted to the swellings. The zooxanthellæ present a curious distribution. Instead of being arranged uniformly throughout the endodermal layer, they are aggregated within restricted areas, and project some distance beyond the ordinary level of the endoderm (fig. 41). No doubt it is this aggregation which produces the granular character of the brown coloration observed in the living tentacles. McMurrich makes no mention of the peculiarity in his specimens of *A. annulata*, but records and figures a very similar condition in *Heteractis lucida* (1896).

The walls of the stomodæum are thrown into numerous small folds, except at the gonidial grooves, which are clearly indicated in sections. Cilia are present all around the stomodæum, but are longer at the grooves. Deeply-staining granular gland cells and long nematocysts are present in the stomodæal ectoderm, and the nerve layer is very evident in places. Muscle fibrillæ occur on the endodermal face of the mesoglœa.

In three Jamaica specimens dissected transversely only the eight Edwardsian mesenteries extend the whole length of the stomodæum; the ventral moities of each of the four lateral pairs, or what are known as the fifth and sixth developmental pairs, are complete in the uppermost region, but for the greater part of the stomodæal extent they are free (fig. 43). Three of the Porto Rican specimens dissected exhibited the same condition of the primary mesenteries, so that it may be assumed to be a general characteristic of the species. Six pairs of mesenteries form a second cycle and are never complete; twelve pairs constitute a third cycle, and twenty-four a fourth cycle. The last project but a little way beyond the column-wall, and do not bear retractor muscles. In one specimen only the second and third cycles bear the gonads in the lower stomodæal region; in another the four free mesenteries belonging to the primary cycle also bear gonads. The directives extending from the angle of the gonidial grooves are shorter than the other complete mesenteries. The large inner mesenterial stomata are easily seen in dissections, and the outer are large marginal apertures some distance from the upper extremity.

The retractor muscles on the three first cycles of mesenteries are strong and form a thickened band along the greater part of the face of each mesentery. The muscle commences a little beyond the origin of the mesentery at the column-wall and, slowly enlarging in thickness, ends centripetally in a rather abrupt manner. The parieto-basilar muscle is well developed, and also the basilar muscle.

The mesenterial endoderm in the lower region exhibits cells with clear contents; granular gland cells and zooxanthellæ also occur. The mesenterial filaments are provided with ciliated and glandular streaks. They are remarkable for the thickness of the endoderm on their outer aspect, which gives them a very exceptional appearance (fig. 44). The middle lobe is somewhat digitiform in transverse section and greatly prolonged beyond the lateral lobes.

Acontia are abundant and contain large thick-walled nematocysts, closely arranged. One example sectionized contained ova arranged in long, narrow, single rows on the mesenteries of the second and third cycles in the upper part of the stomodæum. They were more plentiful around one pair of directives than around the other. In another specimen both ova and spermaria occurred together on the second and third cycle mesenteries, and also on the free fifth and sixth pairs of the primary cycle, so that the species is hermaphrodite. McMurrich's specimens bore immature ova only on the mesenteries of the second and third cycles.

This large and handsome *Aiptasia* is found plentifully all around Jamaica, firmly attached to various objects, such as stones, rocks, and old shells, often to their under surface, the disk with the long tentacles showing above the sea-floor. Sometimes it attains considerable dimensions, having quite an impressive appearance when seen *in situ* with all its long, snake-like tentacles waving gracefully. A variety is occasionally met with in which the diameter of the whole disk and tentacles is 18 or 20 centimeters. In these the outer tentacles are of the usual granular brown color, with white, incomplete rings, but the inner tentacles are a very pale blue, with only a few urticating areas toward the apex, and when fully extended they are extremely delicate objects. The Porto Rican specimens are on the whole smaller than similarly preserved Jamaican examples. The large size which the species occasionally attains places it more in agreement with Lesueur's *A. solifera*, the body of which is stated to be about 4 inches in length (1817, p. 173). McMurrich has already discussed (1889, p. 10) the reasons for uniting the two forms, *A. solifera* and *A. annulata*, regarded by Lesueur as distinct species, and the large Jamaican specimens serve to confirm his conclusions.

The polyps appear very sensitive to light, contracting when exposed to full sunlight in the laboratory, but expanding again if placed in the shade. The long tentacles are usually in constant and graceful motion and are incapable of being much retracted. Acontia are emitted both through the cinclides and the mouth.

The species is now known from the following localities: Barbados (*A. annulata*), "in the hollows formed in madrepore rocks" (Lesueur); Guadeloupe (*A. solifera*), "in old shells, particularly in those of *Turbo versicolor*" (Lesueur); St. Thomas (*B. solifera*), Duchassaing & Michelotti; Bahamas, "attached to the lower surface of the blocks of coral rock, or in cavities in these" (McMurrich); Bermudas, "The largest examples were 8 inches or more in diameter when fully expanded, and had several hundreds of tentacles. The color is generally light green" (Verrill); Jamaica (Duerden); Porto Rico (U. S. Fish Commission).

The fact that the specimens of this species obtained by McMurrich at the Bahamas are octamerous, while the Porto Rican and Jamaican representatives are hexamerous, is of some interest. Eight specimens which I have examined all possessed the mesenterial plan represented in fig. 43, and McMurrich is quite emphatic as to the arrangement in the forms studied by him. Such variability is not unknown in other Actinians. Verrill (1899, p. 216) mentions that he has found specimens of *Urticina crassicornis* which are hexamerous, both as to tentacles and mesenteries, many others decamerous, some octamerous, and a few irregular or unequally developed on opposite sides.

The freedom of the ventral moieties of the four lateral pairs of mesenteries is a retention in the adult polyp of a characteristic met with in larvæ and young polyps. In most Actinian and Madreporarian young polyps the fifth and sixth bilateral pairs of mesenteries, which correspond with those mentioned, remain free from the stomodæum much longer than the other four primary pairs. In most instances they continue thus until the pairs of the second-cycle mesenteries are fully established. In this connection, also, attention may be drawn to the eight free-swimming larvæ, possessed of 24 mesenteries, described by van Beneden in his beautiful work, "Les Anthozoaires de la Plankton Expedition" (1897, pp. 189–194). Although the second cycle of six pairs of mesenteries is fully developed in each case, yet in no instance have the fifth and sixth developmental pairs become complete; only the eight Edwardsian mesenteries extend as far as the stomodæum. I have reared the young polyps of the coral *Siderastræa radians* for a period of seventeen weeks, until the six pairs of second-cycle mesenteries were established, and yet the fifth and sixth pairs of primary mesenteries remained free from the stomodæum.

Subfamily METRIDINÆ Carlgren.

Sagartidæ with column of medium height or low, without papillæ, verrucæ, or marginal spherules. Sphincter mesoglœal, well developed. Cinclides (chiefly endoderm evaginations) present. Complete mesenteries usually six; rarely, especially when only one pair of directive mesenteries is present, more than six. Mesenteries of the first order always sterile. Acontia emitted through the cinclides and mouth. One or two pairs of directive mesenteries.

This subfamily includes the four genera, *Metridium*, *Mitactis*, *Adamsia*, and *Calliactis*. Scarcely any differences exist between the last two genera, but they are strongly marked off from the other two. Both Haddon and Carlgren state that a cuticle is absent, but in *Calliactis tricolor* such a formation occurs, especially obvious in freshly collected specimens. The scapus is covered with a fairly thick, coarse, membranous cuticle, to which foreign particles adhere, and distally it is often found partly detached and hanging loosely. The capitulum is entirely smooth. When polyps are brought into the laboratory the cuticle is sloughed off within two or three days, and the scapus then presents a much clearer appearance.

I have also modified the definition with regard to the extrusion of the acontia. In the West Indian *Calliactis* they are thrown out quite as freely through the mouth as through the cinclides.

Where, as in *Metridium*, only one gonidial groove may occur, with only one pair of directives, and the hexameral plan of the mesenteries generally is disturbed, there is every likelihood that the polyps are the products of fission. In researches which I have recently conducted upon fission in coral polyps I find that in the process the stomodæum is usually divided into two equal or nearly equal parts, usually at right angles to the directive plane. The mesenteries connected with each half, including one pair of directives, go to the formation of a new polyp, or new stomodæal system where fission is incomplete. In the new or daughter polyps, however, a new pair of directives appears to be never formed, and generally the polyps lose all their hexameral regularity. Hence corals reproducing by fissiparity are usually devoid of directive mesenteries, except the two primary pairs which appear in the larva. No doubt similar relationships hold for Actinian polyps. In the Madreporaria gonidial grooves seem never to occur, so that the fate of these structures can not be compared.

Genus CALLIACTIS Verrill.

Calliactis, Verrill, 1869, p. 481; Hertwig, 1882, p. 73; Haddon, 1898, p. 456; Carlgren, 1900, p. 55.
Adamsia, McMurrich, 1893, p. 182.

Metridinæ with prominent cinclides, arranged in from one to several horizontal rows toward the base of the column; no verrucæ. Column usually divided into scapus and capitulum; scapus secretes a membranous cuticle which is shed from time to time; very changeable in form, in full expansion elevated, subcylindrical, with a broadly expanded base, in retraction forming a low, flattened cone or convex disk. Pedal disk with a tough cuticle. Tentacles numerous, slender, subulate, highly contractile. Acontia highly developed, emitted through the cinclides and oral aperture.

The above definition is altered somewhat from Haddon's, which was founded upon that of Verrill, so as to include the cuticular formation. Carlgren does not mention if *C. polypus* is possessed of a capitulum.

Verrill (1869) erected the genus *Calliactis* with *C. decorata* (Drayton) as the type, and included the *Actinia tricolor* of Lesueur to be here described. He distinguishes it from the genus *Adamsia* of Forbes, which exhibits a peculiar low-spreading method of growth involving a union of the polypal base around the shells of mollusks. All the other characters agree so closely that it is very doubtful whether the mere peculiarity of growth should be considered sufficient to constitute a generic distinction.

Hertwig in the *Challenger* Report (1882, p. 74) retained Verrill's genus for *C. polypus*, but in the Supplement (1888, p. 3), following Andres, he states that it must be termed *Adamsia polypus*. Haddon (1898) in his latest paper retains the two genera, and Carlgren (1900) also admits *Calliactis*. McMurrich, however, employs *Adamsia* as the generic term for the present species.

Calliactis tricolor (Lesueur). Pls. III, XII, Figs. 12, 45, 46.

Actinia tricolor, Lesueur, 1817, p. 171.
Adamsia tricolor, Milne-Edwards, 1857, p. 281; Duchassaing et Michelotti, 1866, p. 134; McMurrich, 1898, p. 234, pl. I, figs. 6, 7; pl. II, figs. 1, 2.
Calliactis tricolor, Verrill, 1869, p. 481.
Actinia bicolor, Lesueur, 1817, p. 171.
Calliactis bicolor, Verrill, 1869, p. 481.
Adamsia egletes, Duchassaing et Michelotti, 1866, p. 134, pl. VI, fig. 17.
Calliactis egletes, Verrill, 1869, p. 481.
Cereus sol, Verrill, 1864, p. 214 (*Actinia sol*, Agassiz, MS., 1849).
Adamsia sol, McMurrich, 1893, p. 183.

Fifteen specimens of an *Adamsia*, associated with fragments of an old *Cassis* shell, were obtained from Mayaguez Harbor. Polyps of very different sizes are represented, the basal diameter of some measuring only 1.2 cm., while others are 3.5 cm. They are rarely more than 1 cm. in height, complete retraction having taken place in every case. In all the base is very irregular in outline, the polyps having adapted themselves to the spiral convexities of the incrusted shell. Patches of a dark-brown cuticular membrane in some instances persist between the incrusted surface and the basal ectoderm.

The upper part of the column is infolded to such a degree that the disk and tentacles are completely hidden, only a small aperture remaining toward the middle of the flattened apex. The columnar surface is strongly ridged both vertically and transversely, being divided into small, square, or rhomboidal areas, which give a coarse tuberculated appearance to the polyps. For the most part the column is devoid of any cuticular investment, and toward the base the wall is so thin as to permit of the mesenteries being seen. In most specimens the cinclides can be made out as two or three more or less complete circular rows of darker spots, disposed a short distance above the base.

The above are practically all the external characters which can be made out on the Porto Rican specimens in their present retracted bleached condition, and from these alone it would be practically impossible to establish their specific identity among an admixture of species of the genus *Adamsia*. But the specimens differ in no respect from similarly preserved Jamaican polyps whose identity as *Adamsia tricolor* is beyond dispute, being founded upon the living characters, while, as shown below, only one widely distributed species of *Adamsia* is known to occur in the West Indies.

The species has never been fully described in its living condition. An account is therefore given below in some detail, as presented by the Jamaica representatives. McMurrich (1893, p. 234) has already partly described its anatomy.

Adamsia tricolor occurs plentifully in Kingston Harbor, attached to the shells of the living mollusks, *Pyrula melongena* and *Fasciolaria tulipa*, on dead *Pyrula* shells inhabited by the hermit crab, *Petrochirus* *bahamensis* Oliv., and often on the carapace of other crabs, such as *Pericera cornuta* Latreille. The latter relationship seems of very constant occurrence. The spinous crab is rarely found without many specimens of different sizes of the sea anemone adhering to its carapace and limbs. *Pyrula* shells inhabited by a *Petrochirus* are at times almost completely hidden by the anemones. As many as fourteen polyps have been found on a single shell, occupying almost every position, some even within the mouth, where they must come into close association with the hermit crab.

The polyps usually remain in an expanded condition when alive and appear very hardy, living well in aquaria. They retract quickly upon irritation, the disk, tentacles, and upper part of the column being infolded, but open again almost as readily. The lower part of the body is capable of considerable distention. The column may elongate and then be deeply constricted across the middle.

After two or three days' confinement in an aquarium the thick cuticle loosens and peels off, and the scapus then appears smoother. Should the water become impure the polyps are able to detach themselves and forsake the surface of the shells, move away and remain free, or they may again fix themselves by their expanded base to the smooth surface of the vessel. On irritation of the polyps acontia are emitted freely through the mouth, and apparently less freely through the cinclides. The threads are capable of independent movement after being shot out and can be again indrawn.

External characters.—The base of the polyps is usually spreading and much broader than the column. Generally a horny cuticular secretion intervenes between the ectoderm and the surface of attachment. The base is circular in small specimens, but in larger examples becomes very irregular in outline, adapting itself to the spiral convexities of the shell to which it adheres. The wall is so thin that the lines of attachment of the mesenteries show through, and is highly distensible when the polyp happens to leave its attachment.

The column is short, erect, broad below, narrowing above the middle and enlarging again toward the apex. The proximal part is very irregular in outline, while the middle and upper are circular in section. The wall appears thick and coriaceous, especially after preservation. The division into scapus and capitulum is readily observed in expanded polyps, the surface of the scapus being usually coarse and wrinkled, while that of the capitulum is smooth and more delicate. The coarseness of the former is largely due to the presence of an outer, loose, cuticular investment to which foreign particles adhere, and which is continually being shed in confinement. Often the column presents longitudinal and transverse furrows which give rise to approximately square or rhomboidal areas, more or less regularly arranged, or sometimes it presents distinct tubercles irregularly scattered. The lines or furrows are usually much less marked in living than in contracted preserved specimens.

Two or three alternating cycles of slightly elevated cinclides occur a short distance from the base. In the lower cycle they are smaller, and generally twice as many as in the next cycle. Only two or three members occur in the third uppermost cycle, but these are the largest of the series. They are easily distinguished in the living polyp by their darker color, and project above the general level of the surface. The apertures vary much in number and regularity of arrangement; sometimes certain members may be missing from the cycles, or additions may be intercalated at almost any part of the cinclidal zone. On irritation white or salmon-colored acontia may be extruded through the cinclides, and also through the mouth, as well as through accidental perforations in the disk.

The capitulum appears as a narrow, circular, smooth band at the apex of the column, and is more diaphanous than the scapus.

The tentacles are short, smooth, subulate, entacmæous, closely arranged, and overhanging. In mature polyps they number 192, or even more, arranged according to the formula 6 6 12 48 96. Irregularities or variations from the hexameral plan sometimes occur.

In expanded polyps the periphery of the peristome is slightly depressed, thin-walled, circular, and grooved in correspondence with the radiating, internal attachment of the mesenteries. The central area surrounding the mouth is usually elevated. The mouth is very small, and circular or oval in outline; the lips project but little, and the two gonidial grooves are not readily seen. When much expanded the mouth becomes larger and slit-like, or the stomodæum may be partly protruded. The gonidial groove is then clearly indicated at each end, and the stomodæal walls are seen thrown into six very strong folds on each side. When alive the lateral walls of the stomodæum sometimes meet along the middle, leaving open the grooves at each end, through which currents of water may be established.

The coloration is very complex in character, oftentimes somewhat brilliant, and varying much in different polyps. The base is dark gray. The column is occasionally bright orange, but more often brown and orange, tinged with purple. The cinclides are dark-brown elevated spots, often with yellow margins; two or three white, light yellow, or orange triangular bands extend to them from the margin of the base, or may go beyond. Narrower light bands of variable length occur in the interspaces all round, commencing at the base of the column; irregular light-colored patches may also occur toward the top of the column. When the cuticle is thick the column becomes dirty brown or purplish, due to adhering foreign particles.

The tentacles are gray, usually with faint purplish brown transverse bands or patches on their oral aspect; five or six of these are present on the larger tentacles, but only two or three on the smaller. Often a row of small opaque white or yellow spots extends nearly the whole length of the inner face of each tentacle; larger opaque white patches may also be present. In one specimen the tentacles throughout were a very delicate purple. The disk is yellowish gray. A wavy, disconnected circle of opaque white radiating patches occurs near the base of the tentacles of the four inner cycles, and outside this an irregular dark purple or black cycle extends nearly to the outer margin of the disk. A circle of twelve, opaque white, V-shaped markings is also present about midway between the tentacles and the mouth, the markings corresponding with the third cycle of twelve tentacles, and another cycle of six may be present nearer the mouth, opposite the second cycle of six tentacles. The middle of the peristome is grayish, the lips bright orange, the stomodæum yellowish brown. When fully extended, six dark purple areas within the tentacular and capitular region are seen to alternate with larger colorless patches. The acontia may be either opaque white or salmon colored.*

The diameter of the base of an average-sized specimen is 3 cm.; the height of the column about 2.8 cm.; the diameter of the disk, 1.5 cm. The length of the inner tentacles when expanded is 0.9 cm.; of the outer, 0.25 cm. A large specimen measured 4.5 cm. across the base and was 3.5 cm. in height.

Anatomy and Histology.—The basal wall is very thin compared with that of the column, the difference being determined by the relative development of the mesoglœa. The columnar cells of the ectoderm are long and narrow. Gland cells are numerous, the peripheral portion of which contains granular matter not staining with borax carmine; large clear gland cells are practically absent. The cuticular membrane secreted by the ectoderm of the base, and regarded by McMurrich (1893, p. 182) as characteristic of the genus, is present in some sections, but is readily separable from the ectoderm. The mesoglœa, though moderately developed, is much thinner than in the column-wall; small isolated cells are sparsely scattered throughout. The endoderm is a very narrow layer, and a weak endodermal muscle is developed.

The column-wall in the retracted condition is often very thick, mainly due to the increased development of the middle layer. A thick cuticle, with foreign particles attached, is present in specimens from which it has not recently been sloughed off. In sections the ectoderm is very narrow, and may be much folded in preserved specimens. By contrast with the base, clear or slightly granular gland cells are conspicuous, and form an outer, non-staining zone; a nuclear zone is displayed about the middle of the layer, while scattered nuclei occur more internally. The mesoglœa is greatly thickened and appears fibrous in character, containing many minute connective-tissue cells. Sometimes the fibrous character assumes a reticular appearance, and often the layer incloses minute pigment granules. Toward the apex it narrows abruptly, the capitulum being very thin-walled. Internally the mesoglœa is finely plaited for the support of the endodermal muscle. This latter is best developed below and about the middle of the column, and at the insertion of the mesenteries becomes mesoglœal. The endoderm displays the nerve layer very distinctly.

The sphincter muscle is a strong mesoglœal representative (fig. 45). Above it is very broad, extending nearly across the thick mesoglœa, while below it gradually tapers to its extremity, which is near the endodermal border. In the first part the mesoglœal muscle-containing cavities are so close that the sphincter region, as a whole, appears finely reticular in character, but the chambers soon become distinctly separated from one another. They are then arranged in regular rows, the different

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*The species of *Calliactis* and *Adamsia* are usually gaily and variously colored, even to the acontia. Prof. H. N. Moseley (Q. J. M. Sc., vol. XVII, 1877, p. 4) has investigated the coloring matter of an *Adamsia* obtained off the Philippines. The polyp was a mottled yellow and brown color with pink stripes. The pink coloring matter in the fresh condition yielded a single well-marked absorption band. The acontia, as in *C. tricolor*, were of a light red color, which gave two absorption bands in the green. Carlgren (1900*a*, p. 55) also mentions that the acontia of *Calliactis polypus* (Forsk.) are rose colored, and Haddon (1898, p. 457) describes those of *C. miriam* (H. & S.) as salmon colored.

cavities varying somewhat in size and outline in transverse section. Toward the lower extremity the linear character is almost lost, the chambers becoming irregularly arranged.

The form of the sphincter here represented should be compared with that which McMurrich gives of the same species (1898, pl. I, fig. 6; pl. II, figs. 1, 2). It will be seen that they present certain differences as regards the arrangement of the muscle-bearing cavities. Neither McMurrich's description nor figures give any indication that the cavities are arranged in transverse rows, though he speaks of an appearance of two or three longitudinal bands of mesoglœa. The reticular region occurs in both instances, but occupies a much larger proportion in the Cuban polyp; in the latter the remaining cavities are irregularly arranged, while they form very distinct rows in the polyps now under examination.

The differences between the two are so great that one would be inclined to doubt their specific identity. In other polyps which I have sectionized, however, intermediate conditions are met with. Sometimes only a slight indication of the linear arrangement of the rows is exhibited, and the reticular portion also varies much in extent. I am inclined to regard the differences in the character of the sphincter as in some measure dependent upon the age of the polyp. The specimen from which fig. 45 was taken was a young polyp only about two-thirds of a centimeter in diameter. McMurrich's single specimen (2.7 cm. in height, the diameter near the base about 2 cm.) was a medium-sized individual. Other examples which I have studied, and in which the appearance more nearly resembles that of the Cuban polyp, are also mature. It may be that with age the regularity of the chambers characteristic of young polyps becomes broken up. Were it merely an individual variation the possibility of a sphincter muscle of any species exhibiting such marked differences would greatly lessen the value which has been placed upon it for taxonomic purposes.

The tentacles display a very broad ectoderm, loaded peripherally with narrow nematocysts. The longitudinal muscle fibers are moderately well developed on deep, narrow mesoglœal plaitings; the endoderm presents irregular internal boundaries, the cells being much vacuolated. A strong endodermal muscle occurs and pigment matter is present in some abundance, but no zooxanthellæ occur within the endoderm of this or any part of the polyp. Professor McMurrich (1893, p. 182) also found a bright reddish orange pigment everywhere in the endoderm of *Adamsia involvens*, without mention of any zooxanthellæ.

The three layers of the disk much resemble those of the tentacles, but the ectoderm is nearly devoid of nematocysts and contains many gland cells. Both the endodermal and ectodermal discal muscles are strongly developed toward the tentacular region, but do not become mesoglœal.

The stomodæum is much folded in sections, and the gonidial grooves are only feebly indicated. The ectoderm is richly ciliated all round; narrow nematocysts and glandular cells with granular contents are observable toward the periphery of the layer, while the broad, deeply staining nuclear zone occurs below. The mesoglœa and endoderm are very thin; an ectodermal nerve layer and endodermal musculature occur.

Six pairs of perfect mesenteries occur, two pairs of which, the directives, are radially shorter than the others. Six pairs of secondaries alternate, and are never complete; four pairs of these bear mesenterial filaments more abundantly coiled than on the other two. Twelve pairs of mesenteries form a third cycle, and the mesenterial filaments on these are but slightly developed; twenty-four pairs of very short mesenteries form a fourth cycle. Representatives of a fifth cycle are present in large polyps, but the full number, forty-eight, appears to be rarely reached. The second, third, and fourth cycles bear the gonads in three examples sectionized transversely. Hints of a dorso-ventrality in the polyps are indicated in that the reproductive organs may not be present on a few of the mesenteries around one of the pairs of directives, while they are fully developed at the opposite aspect. In two young polyps only the first, second, and third mesenterial cycles were present. The third cycle of twelve was very fully developed, though no trace of the members of the fourth cycle could be found.

The mesenteries are usually thin at their origin from the body-wall and broader beyond. The retractor muscles occur on branching mesoglœal plaitings, extending over the greater part of the width of the mesenteries. In the second cycle the retractor muscle may be somewhat circumscribed in character. The endoderm becomes much thickened below the stomodæum, and contains many granular particles and a little brown pigment matter. The parieto-basilar muscles appear to be absent, or, at any rate, no mesoglœal pennons are formed for their support. McMurrich was unable to find any basilar muscle, but a very feeble pair occurs, as represented in fig. 46.

The mesenterial filaments occur on all the mesenteries except the members of the last cycle, and possess both ciliated and glandular streaks. The ciliated streak has only a very short course, disappearing from all the mesenteries a little below the level of the stomodæum. The acontia are crowded with narrow elongated nematocysts.

The male and female reproductive cells occur in different individuals. Both are developed in enormous quantities on the second, third, and fourth mesenterial cycles.

Lesueur (1817, p. 171) has described from the West Indies the two species *Actinia tricolor* and *A. bicolor* as distinct, and Duchassaing & Michelotti (1866, p. 234) have added a third, *A. egletes*. McMurrich (1898, p. 234), however, has discussed the validity of these three species, and finds that it is impossible to maintain their separation, a conclusion with which I agree. McMurrich has further decided that the *Actinia sol*, Agass. MS. (Verrill, 1874, p. 24), of the Carolina coast is indistinguishable from the West Indian species. Therefore the West Indies appear to possess but one species of *Calliactis*, with a range extending northward as far as the eastern coasts of the United States.

In addition to Jamaica and Porto Rico, the species is now known from the following islands: Barbados (*A. tricolor*), attached to shells tenanted by hermit crabs (Lesueur); St. Vincent (*A. bicolor*), adherent to shells (Lesueur); St. Thomas (*A. egletes*), upon shells and the carapace of the living *Pericera cornuta* (Duchassaing & Michelotti); Bahia, Cuba (McMurrich); also near Charleston, S. C. (Agassiz, Verrill).

Order STICHODACTYLINÆ Andres.

Actiniaria in which more than one tentacle may communicate with a mesenterial chamber. Usually a peripheral series of one or more cycles can be distinguished from an inner or accessory series, the members of which are radially arranged or in groups, and are often of different form. Sphincter muscle either endodermal or absent.

Next to the arrangement of the mesenteries, the disposition and character of the tentacles has been found of great service for classificatory purposes in the Actiniaria. The proposal of Andres to separate the *Hexactiniæ* into two groups, *Actininæ* and *Stichodactylinæ*, according as only one tentacle or more than one may arise from a mesenterial chamber, has in the past met with universal acceptance. Beyond the mesenterial plan it is recognized that within different groups different characteristics may assume particular importance, especially for the minor subdivisions. No mesenterial distinction avails to separate the *Actininæ* from the *Stichodactylinæ*, and within the various families of the former no very great difference in the tentacular plan is presented, while great diversity occurs in the latter. Therefore in the *Actininæ* the tentacles have not assumed that taxonomic importance which has been assigned them in the *Stichodactylinæ*. In the former the character of the musculature has been found to be of greater utility in determining what may be considered natural relationships.

In my paper on the Jamaica *Stichodactylinæ* I refer to the great variation presented by the tentacular systems of the different genera there studied, and consider it very doubtful if there is much homologous connection among them; more likely they are polyphyletic. To my mind, however, one great distinction is recognizable, according as the tentacles are all of one form or of two forms; and for these I suggested the two suborders *Homodactylinæ* and *Heterodactylinæ*.

The conception underlying the separation is altogether at variance with that which Carlgren is endeavoring to introduce, and in the "Nachschrift" to his "Ostafrikanische Actinien" (p. 116) he somewhat petulantly characterizes the division as "nicht viel besser, als wenn man die Actiniarien nach der verschiedenen Zahl der Tentakelcyklen einteilen wollte." Carlgren naturally regards every proposal in the light of its relationship with his own scheme, according to which he is seeking to combine all the forms with primary characteristics to the neglect of their later modifications. The division referred to above is based wholly upon these latter, and regards the species retaining the primary characters as the lowest of their own particular group. For example, within the *Stichodactylinæ* it is probably impossible to mention two species more widely divergent in their tentacular plan than *Ricordea florida* and *Actinotryx sancti-thomæ*. In the former the marginal and inner tentacles are all of the same form, arranged in regular radial rows; in the latter the marginal tentacles are simple, and two or three orders are represented in a single cycle; the inner tentacles are dendroid, separated by a naked space from the marginal, and are arranged in a middle discal and a circumoral group. Morphologically the two tentacular series—marginal and accessory—seem wholly unconnected with one another in *Actinotryx*, while they probably form a consecutive series in *Ricordea*. The two species are alike, however, in the absence of a basilar muscle, ciliated streak, and gonidial grooves, and each possesses only a weak musculature. On account of these characteristics, to the neglect of the tentacular divergences, they are classed together by Carlgren in the one family *Discosomidæ*.

Recognizing them as forms which retain the ancestral attributes just mentioned, but in other respects have become widely divergent, I see nothing illogical in considering *Ricorda* and *Actinotryx*, respectively, as among the lowest members of the two suborders *Homodactylinæ* and *Heterodactylinæ*, and for the present I propose to retain the two subdivisions.

Suborder HOMODACTYLINÆ.

Stichodactylinæ in which the tentacles are all of one kind, simple or complex, and usually follow one another in continuous radial rows.

Family STOICHACTIDÆ Carlgren.

Stoichactidæ, Carlgren, 1900, p. 278; 1900*a*, p. 72 (also p. 119).

Stichodactylinæ with a basilar muscle and well-developed basal disk. Sphincter always present, shortly diffuse or circumscribed, usually not strongly developed, with well-marked gonidial grooves and ciliated streaks. Column usually provided with a distinct fossa and adhesive verrucæ. Longitudinal musculature of the mesenteries well developed. The separation of the tentacles into a marginal and a discal series not pronounced; only one tentacle arises from each exocœle; tentacles simple or branched, sometimes swollen at the apex, never arranged in groups, nor as arm-like prolongations of the disk.

Reviewing the family *Discosomidæ* (1900, p. 155) I state: "As the Actiniaria of tropical regions are more studied, the genera embraced under this family become more and more numerous . . . it will be seen that the family includes a very heterogeneous assemblage of forms, corresponding in this respect with the *Sagartidæ* among the *Actininæ*. The only constant feature appears to be that the tentacles are all of the same form in any one species, and cover the greater portion of the disk; but apparently in no two genera are the peripheral and the inner tentacles similarly related. It will probably be found advisable later to separate as subfamilies forms in which only one row of tentacles communicates with a mesenterial chamber from those in which, as in *Actinoporus*, two or more rows may originate from the same mesenterial chamber."

At this time Carlgren was working upon a large assemblage of *Stichodactylinæ*, including specimens of the Jamaica representatives which I was able to send him. The papers of Haddon (1898) and Kwietniewski (1897, 1898), describing many new forms, had also appeared. Carlgren was therefore in a most favorable position for carrying forward the classification of the group, and this he has accomplished in a very elaborate manner. His first suggestions are contained in a short paper, "Zur Kenntnis der Stichodactylinen Actiniarien" (1890), followed the same year by that on the "Ostafrikanische Actinien." In these the value assigned the family distinction is very diverse. In some instances Carlgren chooses to attach supreme importance to the characters of anatomy and histology alone, and thus brings together many forms (e. g., *Ricorda*, *Actinotryx*) allied in anatomical and histological details, but outwardly most diverse, while in other cases—*Stoichactis*, *Homostichanthus*, and *Actinoporus*—new families, almost alike in their anatomy and histology, are constituted mainly upon tentacular differences.

In the first paper he defines the families *Discosomidæ*, *Stoichactidæ*, and *Aurelianidæ*. The first includes forms without basilar muscle, ciliated streak, and gonidial grooves, and with weak mesenterial musculature, and embraces the genera *Discosoma* (*D. nummiforme*, type), *Orinia*, *Ricordea*, *Actinotryx*, and *Rhodactis*, thus including the most heterogeneous tentacular plans. The *Stoichactidæ* and *Aurelianidæ* include forms in which all the organs just mentioned occur and in which the mesenterial musculature is better developed. Along with these, and mainly distinguished by their tentacular arrangement and form, are the *Phymanthidæ*, *Heteranthidæ*, *Thalassianthidæ*, and *Actinodendridæ*.

The family *Stoichactidæ* is defined above. It includes the genera *Stoichactis*, *Radianthus*, *Helianthopsis*, and *Antheopsis*. Carlgren has been able to compare the form I identify as the West Indian *Actinoporus elegans* with the European *Aurelianìa*, and, contrary to what I formerly expected from Gosse's description and figure, shows that they agree very closely. The two genera constitute the family *Aurelianidæ*.

In the "Nachschrift" (p. 118) to his last paper Carlgren erects another new family, *Homostichanthidæ*, for the species I have described as *Homostichanthus anemone*, but which he names *H. duerdeni*. Its chief distinction from the family *Stoichactidæ* lies in the origin of many tentacles from each exocœle, as well as from the entocœles, a character in which it agrees with the *Aureliania*.

Genus STOICHACTIS Haddon.

Stoichactidæ usually of large size, column smooth below, with or without verrucæ above. Tentacles short, simple, subulate, rounded or capitate, covering nearly the whole of the disc. A single tentacle from each exocœle constitutes the most peripheral cycle; usually many tentacles, arranged in a single radial row, arise from each entocœle. Sphincter muscle strong and circumscribed, or circumscribed-diffuse. Usually two gonidial grooves.

Stoichactis helianthus (Ellis). Pl. I, Figs. 1*a*, 1*b*.

Actinia helianthus, Ellis, 1767, p. 436, pl. XIX, figs. 6, 7.
Discosoma helianthus, Milne-Edwards, 1857, p. 256; Duchassaing et Michelotti, 1866, p. 122; Andres, 1883, p. 493.
Discosoma anemone, McMurrich, 1889, p. 37, pl. I, fig. 8; pl. III, figs. 15, 16; pl. IV, fig. 1.
Stoichactis helianthus, Duerden, 1900, p. 162, pl. XI, fig. 7; pl. XIV, fig. 1.

This is a prominent Discosomid around Jamaica and other West Indian islands, including also the Bahamas (McMurrich), and the same must be the case in Porto Rican waters, for in the collection it is represented from most localities, often by numerous large specimens. It is met with on the coral reefs and sandy sea-floor at depths of two or more fathoms, and when alive different polyps vary much in color. Sometimes a number occur together in close contiguity, forming extensive patches. The variety of form which the polyps may assume on preservation is well illustrated by the many Porto Rican examples available for comparison. The tentacles especially differ in their appearance in the preserved examples, and, being very numerous, determine the general appearance of the polyps. Sometimes they are shrunk and widely apart; at other times they are more distended, and clothe the disk more completely. Two somewhat extreme cases, obtained from Fajardo, are represented by the photographic reproductions on pl. I. The essential characters of the species have already been described by McMurrich (1889) and myself (1900).

External characters.—The base is flat, usually adherent to the surface of rocks, and is a little larger in diameter than the lower part of the column. Preserved examples show strong concentric and radiating ridges and furrows.

The column is short and salver-shaped, narrowing a little above the base, and then expanding enormously in a crateriform manner; usually the column is partly embedded in sand and the distal region overhangs. The walls are smooth, thin, slightly transparent, and grooved. Distally, vertical rows of flat, oval, green verrucæ occur, but are incapable of holding foreign particles to the column. The apex of the column is rounded, devoid of acrorhagi, but with a very distinct fossa. The column is incapable of being infolded completely so as to cover the disk.

The disk is flat and greatly expanded. By far the greater part is covered with radiating rows of tentacles, more crowded toward the periphery. In young polyps a cyclic order in the radial extent of the different rows of tentacles can be established, but is mostly lost in large specimens. A single outermost cycle of exocœlic tentacles alternates with all the radial rows; the latter are entocœlic. The tentacles are short and digitiform, but vary a little in shape and size, according to the degree of distension. In the preserved condition they may become vesicle-like, or remain conical or digitiform, the surface finely fluted from apex to base. Small tentacles are seen in process of growth around the margin, but within the exocœlic cycle.

The central naked area of the disk is smooth, and the peristome is somewhat elevated. The mouth is large and oval. Two gonidial grooves are usually present, readily distinguished by their thickened margins; rarely three may be present.

The base is white or cream colored; the column white or cream below, and a little darker above. Large, irregular green patches may occur on the column, and distally vertical rows of small, oval, green areas represent the verrucæ, their number and closeness varying much in different rows. The disk may be a light or dark olive brown, and the tentacles the same, but irregular patches of varying intensity are exhibited. The peristome is a brownish yellow, the lips a deep rich yellow, and the stomodæal wall white. Color varieties are frequently met with. In one the column and disk are almost entirely colorless, and the tentacles a clear sulphur yellow.

The diameter of the base is about 5 cm., and the height of the column 4 cm. The diameter of the disk usually varies from 10 to 12 cm., or may be more in fully expanded specimens. The tentacles are about 0.6 cm. in length, and are often largest in diameter toward the tip, where they may measure 0.2 cm. across. The diameter of the naked part of the disk is about 2.5 cm.

Anatomy and Histology.—The basal disk is of considerable thickness. The ectoderm is an exceptionally broad layer and contains many narrow, elongated gland cells with granular contents; the mesoglœa presents delicate plaitings on its endodermal border for the support of a well-developed circular endodermal musculature.

The column-wall is of only moderate thickness; the ectoderm is deeply folded, the mesoglœa partly following. Numerous long granular cells are included among the supporting cells, and the mesoglœa presents a delicate fibrous structure with many connective-tissue cells. On the endodermal surface the latter forms narrow branching plaits for the support of the circular musculature. The endoderm is much thinner than the other two layers and contains many zooxanthellæ and granular gland cells. At the verrucæ the ectoderm consists almost wholly of supporting cells, gland cells are absent, and the ciliation is more obvious. Histologically, therefore, the organs most closely resemble the sucker-like verrucæ of other Actinians.

The sphincter muscle is strong and circumscribed, and made up of several lobes, so that its outline varies in different transverse sections. The pedicle is broad and short, and a narrow mesoglœal axis extends nearly the whole length.

Both the entocœlic and exocœlic tentacles are simple outgrowths of the disk, with the three constituent layers of about equal thickness. Long, narrow nematocysts occur in a peripheral zone toward the apex. The endoderm is crowded with zooxanthellæ and coarsely granular gland cells. The endodermal and ectodermal musculatures are developed, the latter being the stronger and associated with a nerve layer.

The discal ectoderm is nearly devoid of nematocysts and contains granular gland cells. The mesoglœa is deeply plaited on its endodermal border for the support of the circular muscle, while the radial ectodermal muscle is weak.

In young polyps the mesenteries are arranged in hexameral orders, but the regularity is lost in older specimens. One young example possessed twelve pairs of perfect mesenteries, an alternating cycle of twelve pairs stretched about halfway across the disk, and another cycle of twenty-four pairs extended just beyond the column-wall. In another polyp thirty-six pairs of mesenteries reached the stomodæum. Older polyps seem to possess merely an alternation of complete and incomplete pairs.

At the insertion in the column-wall the mesenteries are narrow and then thicken abruptly, the retractor muscle extending nearly across the face, again terminating in an abrupt manner in the imperfect pairs, but gradually in the perfect members. The face of the mesentery where the retractor muscle is well developed is somewhat undulating. The endoderm is loaded with coarsely granular cells. The parieto-basilar muscle is weakly developed. The inner mesenterial stomata are large, while the parietal are small circular apertures. The basilar muscle is well developed, of the type represented for *Asteractis expansa* and *Bunodosoma spherulata.* Gonads may occur on all the mesenteries.

Localities: West Indies (Ellis), Guadeloupe, St. Thomas, etc. (Duchassaing & Michelotti), Bahamas (McMurrich), Jamaica (Duerden), Porto Rico (U. S. Fish Commission).

Another large West Indian Discosomid, *Homostichanthus anemone* (Ellis) Duerden, is rarer than the former, and is not represented in the *Fish Hawk* collections. Both species appear to be absent from the Bermudas, not being recorded by McMurrich or Verrill, but *S. helianthus* is plentiful at the Bahamas.

Carlgren (1900*a*, p. 76) has come to the opinion, first adopted by McMurrich, that Ellis's figures of *Actinia helianthus* and *A. anemone* are best regarded as representing only one species. In Turin, Carlgren had the opportunity of examining one of Duchassaing & Michelotti's specimens, which these authors had named *D. anemone*, and states that it is the same form as that described by McMurrich under this name. He then observes that Ellis's original figure of *A. helianthus* are without doubt referable to the same form as that which Duchassaing & Michelotti and McMurrich had under consideration, and therefore accepts my determination of it as *D. helianthus.* It becomes necessary, therefore, that the Jamaican form I identify as *D. anemone* should be given a new name. In the "Nachschrift" (p. 117) Carlgren suggests *Homostichanthus duerdeni.*

Carlgren's conclusions merit consideration, for, in addition to the opportunities above mentioned of studying the two forms, he has had for comparison specimens of both species which I have sent him from Jamaica. I have, unfortunately, not had the opportunity of examining Ellis's original figures, which are really the determining factors in the dispute. My conclusion that the rarer Jamaican species was *anemone* was based mainly upon the fact that Ellis records the angular form of disk of *anemone*, and that Duchassaing & Michelotti refer to the peculiar rapid color variation which the species undergoes. While certainly not very reliable characteristics, yet, knowing the fairly uniform distribution of the Actiniaria throughout the West Indian area, it seemed not unlikely that Ellis and Duchassaing & Michelotti might well have met with the two Discosomids which occur around Jamaica.

In a "Nachschrift" to his "Ostafrikanische Actinien," Dr. Carlgren takes the opportunity of criticising some of the results in my recent paper on the Jamaican *Stichodactylinæ*. With regard to the above species he remarks as follows:

"Bei allen von mir untersuchten Exemplaren von *Stochactis helianthus*—auch bei denen, die Duerden mir gütigst geschickt hat—stehen die Exocœltentakeln sozusagen in etwa demselben Cyklus wie die äussersten Endocœltentakeln, ja sehr selten etwas innerhalb der äussersten Endocœltentakeln. Die Figur Duerden's (Taf. XI, Fig. 7) wäre nach meiner Meinung richtiger, wenn Duerden in jedem Endocœl ausserhalb der äussersten Tentakeln noch einen Tentakel eingezeichnet hätte."

The criticism is very trivial, for, in the description of the species, I refer to the crowded character of the tentacles around the margin. The figure referred to is altogether diagrammatic, its main purpose being to show the important fact of the exocœlic origin of the outermost cycle, compared with the entocœlic origin of the radial rows.

With regard to the diagrammatic figure of the tentacles of *H. anemone*, Carlgren writes:

"Was schliesslich *Homostichanthus Duerdeni* (ich nenne diese Art so anstatt *H. anemone;* vergl. *St. tapetum*, p. 77) (p. 97) anbetrifft, so kann ich Duerden's Angabe von dem Vorhandensein mehrerer Tentakeln in jedem Exocœl bestätigen, aber die Figur Duerden's (Fig. 4, Taf. XII) von der Tentakelanordnung stimmt nicht gut mit meinen Untersuchungen überein. Eine solche Anordnung der Tentakeln in einfachen radialen Serien kann ich nur in den schwächsten Endocœlpartien finden. Von jedem stärkeren Endocœl entspringen dagegen nur in den inneren Mundscheibenpartien Tentakeln in einer Reihe, nach aussen hin in dem gefalteten Mundscheibenteil stehen zwei Längsreihen neben einander und in der Peripherie selten drei. Die Anordnung in bestimmten Reihen in den äusseren Partien der Endocœle ist jedoch, ganz wie in den Exocœlpartien, sehr unregelmässig, aber auf die Breite jedes Faches kommen 2-3 Tentakeln. Von den Exocœlen gehen in den peripherischen Teilen der Mundscheibe Tentakeln aus; nach innen hin steht ein Tentakel, nach aussen finden sich Reihen von zwei (selten drei) Tentakeln neben einander. Die Tentakelzonen der Exocœle bilden also trianguläre, mit der Basis nach aussen, der Spitze nach innen hin gewendete Partien. Man könnte einwenden, dass diese Anordnung durch die Kontraktion entstanden wäre; so weit ich finden kann, ist es entschieden nicht so; besonders bei dem einen untersuchten Exemplar sind mehrere Mundscheibenpartien, die die Tentakeln in oben geschilderter Weise tragen, gut ausgestreckt. Eine bessere Figur der Tentakelanordnung des *Homostichanthus* scheint mir also von Nöten zu sein."

In this case the difference between Carlgren and myself may be understood when it is remembered that my description was founded upon both the living and preserved appearances of the polyp, while Carlgren had for examination only the preserved specimens which I sent him. From dissections of the polyp I had obtained all the appearances which Carlgren refers to, and it is easy to understand how he has been led astray in his interpretation of the tentacular disposition, and to assume that I was in error. I think Carlgren will agree that the true external characteristics of any species are more likely to be appreciated in the living than in the preserved condition, and that in any case the living features should take precedence of those in the shrunken preserved animal. In my description I state (p. 168):

"Peripherally, the tentacles are so closely arranged that on a slight contraction of the polyp the apices press one against the other and assume a polygonal outline, and sometimes more than one row appears to communicate with a mesenterial chamber."

From the numerous living specimens which I had under observation, and the importance which I have attached to it in all the species described, it may be expected that I should satisfy myself as to the actual disposition of the tentacles in their relationships with the mesenterial chambers. Again examining dissections of my preserved specimens of *H. anemone* from within, I find that in most expanded individuals there is but slight evidence of the doubling of the rows peripherally, while in the most contracted examples two very distinct rows may be presented and, in places, evidence of the intercalation of a third row. It is obvious that the tendency to a disposition of the tentacles in rows upon shrinkage will be accentuated by the very crowded arrangement of the tentacles peripherally where, as I show to be the case more centrally, the tentacles are less crowded, there is no lateral overlapping, and the tentacular apertures are arranged directly behind one another in a single row. Even in *Stoichactis helianthus*, where the tentacles are by no means so closely disposed in the living polyps, an overlapping arrangement, as if the tentacles arising from each interspace were in a double row, is at times presented by preserved polyps. The confusion which Carlgren has introduced simply emphasizes how very necessary it is, in dealing with such strongly retractile animals as anemones, that the polyps should as far as possible be studied in the living condition, as well as from preserved material.

Suborder HETERODACTYLINÆ.

Stichodactylinæ in which the tentacles are of two forms, usually marginal and accessory, and separated by a naked portion of the disk.

Family PHYMANTHIDÆ Andres.

Stichodactylinæ in which the tentacles are of two kinds. Marginal tentacles arranged in several alternating entacmæous cycles, laterally tuberculiferous or frondose; inner tentacles radially or irregularly arranged, very small, tubercular or papilliform.

Genus PHYMANTHUS Milne-Edwards.

Phymanthidæ in which the column is smooth or provided with longitudinal rows of verrucæ in its upper part, and usually terminated by a cycle of rounded acrorhagi. Sphincter muscle absent or endodermal and very weak.

Professor Verrill (1898, p. 496) has suggested that the generic term *Epicystis* should take the place of *Phymanthus* on the ground that Ehrenberg in 1834 had proposed *Epicystis* for the *Actinia crucifera*, *A. ultramarina*, and *A. granulifera*, all of Lesueur, and that the first was evidently different from Milne-Edwards's type of the genus *Phymanthus*, viz., *P. loligo*. Dr. Carlgren (1900*a*, p. 66), however, has shown that this alteration can not be sustained, that *Phymanthus crucifer* and *P. loligo* must belong to the same genus.

Phymanthus crucifer (Lesueur). Pl. III, Fig. 13.

Actinia crucifera, Lesueur, 1817, p. 174.
Cereus crucifer (*Actinia*), Duchassaing & Michelotti, 1866, p. 125, pl. VI, fig. 13.
Phymanthus crucifer, Andres, 1883, p. 501; McMurrich, 1889, p. 51, pl. II, fig. D; pl. IV, figs. 6–11; Duerden, 1900, p. 139, pl. X, fig. 1, 2; pl. XI, figs. 1, 2.
Epicystis crucifera, Verrill, 1898, p. 496.
Epicystis osculifera, Verrill, 1900, p. 556 (=*Actinia osculifera*, Les.).

Several specimens of this large, handsome anemone are included in the collection, but present a very different aspect from that of the polyps in their living condition, when buried in coral sand or coral rock with the expanded wavy disk alone visible. The marginal tentacles are greatly shrunk, but still display the oro-lateral thickenings, while the disk papillæ are very numerous and somewhat irregularly arranged. Owing to the absence of any sphincter muscle the polyps on preservation are incapable of infolding the disk and tentacles. One example is completely everted.

External characters.—The basal disk is adherent to rocks and stones, and exhibits coarse radial and fine concentric wrinklings, and is a little larger than the proximal region of the column.

The column is erect, thin-walled, and smooth in living polyps, but preserved specimens are wrinkled both vertically and transversely. When alive the polyps enlarge slowly from just above the rounded limbus until distally the diameter may be two or three times that below. The upper region of the column, along with the periphery of the disk, is sinuous, and *in situ* this rests upon the surface of the sea-floor. It exhibits rows of sucker-like verrucæ, corresponding with the principal mesenterial interspaces; four to six large verrucæ occur in each row, and a few rudimentary examples are continued below. A single apical verruca may alternate with the principal rows. A circle of prominent rounded acrorhagi occurs at the apex of the column, double in number the rows of verrucæ, and alternating with the outermost cycle of tentacles. Sometimes a smaller acrorhagus alternates with each of the larger. A shallow fossa intervenes between the acrorhagi and base of the tentacles. The column-wall is incapable of folding over the disk and tentacles. The marginal tentacles are arranged in numerous entacmæous cycles, and usually number between two and three hundred. They are shortly conical and overhanging, the oral face being longer than the aboral or outer. The members of the first and second cycles are situated some little distance from the other cycles. Normally the cycles are hexamerous, but irregularities are frequently met with. Usually the tentacles bear several transverse opaque thickenings, most strongly developed along the oro-lateral area, where a distinct bilobation is often observable. Six or seven pairs, arranged pinnately, the middle pairs being the largest, may occur on the larger tentacles, and a less number on the smaller tentacles. For some little distance from their origin the tentacles are smooth, and polyps occur in which the tubercles are altogether undeveloped. Among a number of polyps from one locality every stage could be obtained between the full development and total absence of the thickenings, some tentacles possessing the full number and others being wholly destitute of them.

The inner tentacles are small papilliform projections of the discal wall, varying much in size, and arranged mostly radially. They correspond with the interspaces of the first and second cycles of mesenteries, and sometimes with those of the lower orders.

The disk is large, thin-walled, and peripherally is thrown into eight to twelve sinuous folds, which overhang the column; the middle region is flat or slightly convex. The gonidial grooves are clearly indicated, the lips being thicker and lighter than the rest of the stomodæal wall.

The coloration is very variable, and all gradations can be traced in a large series of polyps. The disk colors are mostly brown and green, with opaque white spots and blotches; those of the column and base are scarlet and crimson on a white or cream ground. The center of the verrucæ is deep crimson; the tentacular thickenings usually appear as white bands. When the tentacles are smooth they are brown or reddish brown, with light crimson tips, and three longitudinal lighter lines traverse the oral aspect. The peristome is usually iridescent green.

The dimensions are likewise very variable, according to age. In many young specimens the column was only 1.1 cm. long, and the diameter 0.8 cm. The length of the column in adult specimens is about 6 cm., the middle diameter 1.7 cm., and the basal 2.5 cm.; the diameter of the disk varies from 5 to 9 cm.; the innermost tentacles are 0.7 cm. in length.

Anatomy and Histology.—The ectoderm of the base is a very broad columnar epithelium, with a few gland cells, and is much folded in sections. The mesoglœa appears strongly fibrous and contains numerous connective tissue cells. Numerous zooxanthellæ occur in the endoderm, and muscle fibrils are present.

The column-wall is of only medium thickness, becoming more delicate distally. The ectoderm is broad and deeply ridged, the elevations being followed by the mesoglœa. Clear and granular gland cells are abundant, and also small nematocysts. A nerve layer occurs, and what I consider to be a very delicate muscle layer in the upper part of the column. The endoderm is a deep layer containing zooxanthellæ, and the circular endodermal muscle is well developed on fine mesoglœal plaitings. The muscle is nowhere concentrated to form a special sphincter. The verrucal ectoderm shows an absence of gland cells and nematocysts.

Both the ectodermal and endodermal musculatures are well developed in the peripheral tentacles, supported on mesoglœal plaitings. The nematocysts in the ectoderm are exceptionally small. The tentacular swellings are due mainly to an increase in the thickness of the mesoglœa.

The disk is thin-walled and the endodermal circular muscle is well developed on mesoglœal folds. The discal papillæ are simple hollow upgrowths; the mesoglœa and endodermal musculatures become so thin as to be scarcely recognizable, and the ectoderm is thinner than elsewhere.

The stomodæum is very elongated in transverse sections, extending almost across the cœlenteron, the pair of directives at each extremity being shorter transversely than the other mesenteries. The walls are thin and the ectoderm is thrown into irregular vertical folds. The two gonidial grooves are clearly indicated, their ectoderm unfolded, and the mesoglœa not much thicker than elsewhere. Longitudinally the stomodæum is comparatively short, but the groove at each end is prolonged for some distance below the lateral walls. Narrow gland cells occur, and a weak longitudinal ectodermal musculature and ganglion layer are recognizable.

In mature polyps the mesenteries of the first three orders reach the stomodæum, though the third and second orders may not extend throughout its length; a fourth and a fifth order may also be developed, the formula being 6 6 12 24 48. The mesenteries are comparatively narrow in transverse section, and by no means crowd the cœlenteron. The retractor muscle is arranged on narrow, bifurcating mesoglœal plaitings, the enlargement commencing in a rounded or acute manner some distance from the column-wall. The mesenterial epithelium is narrow and highly vacuolated, the protoplasmic contents being aggregated toward the margin. The parieto-basilar muscle is well developed, situated on a strongly plaited pennon. The basilar muscle is strong and closely resembles that of *Asteractis expansa*. The perioral stomata are large, but the parietal are small and not easily distinguished. Trilobed filaments are borne by the members of the first three orders of mesenteries.

All the mesenteries may be gonophoric, and apparently the polyps may be monœcious or diœcious.

Localities.—Barbados (Lesueur), St. Thomas (Duchassaing & Michelotti), Bahamas (McMurrich), Bermudas (Verrill), Jamaica (Duerden), Porto Rico (U. S. Fish Commission).

In general the species is easily distinguished among West Indian anemones by the transverse white ridges on the oro-lateral aspect of the tentacles. The character, however, is not as readily recognizable on preserved specimens as on the living polyps. Further, at Drunkenman's Cay, beyond Port Royal, Jamaica, where *P. crucifer* occurs in abundance, specimens are occasionally found in which the tentacular swellings are altogether absent, while others exhibit all intermediate stages in their presence or absence.

In his most recent paper Verrill (1900, p. 556) identifies the form devoid of the tentacular ridges as the *Actinia osculifera* of Lesueur (1817, p. 175). If intermediate stages toward the full development or absence of a specific character mean anything at all, it is clear that the form Verrill identifies as *A. osculifera* can not be considered as a species distinct from *P. crucifer*. Verrill states:

"This species or variety scarcely differs from *E. crucifera* except in lacking the transverse white ridges on the tentacles, characteristic of the latter. The colors of the two forms are similar and are variable in the same way in each."

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EXPLANATION OF PLATES.

Figures 1*a*, 1*b*, are from photographs by Dr. A. M. Reese; figures 2 to 13 were drawn by Mr. C. H. Prinke under the supervision of the author; all the others were drawn by the author.

PLATE I.

Figs. 1*a*, 1*b*. *Stoichactis helianthus*. Photographic reproductions of two preserved polyps, showing the differences in character which may be assumed by the tentacles.

PLATE II.

Fig. 2. *Zoanthus pulchellus*. A colony of retracted preserved polyps in which the individuals are long and close, and hide the cœnenchyme.

Fig. 3. *Zoanthus pulchellus*. Portion of a preserved colony in which the polyps are shorter, and the intervening continuous cœnenchyme is partly displayed.

Fig. 4. *Zoanthus sociatus*. Portion of a colony of retracted polyps.

Fig. 5. *Isaurus duchassaingi*. Retracted polyp.

Fig. 6. *Protopalythoa variabilis*. A small irregular group of retracted polyps.

Fig. 7. *Palythoa caribæa*. A small colony of partly expanded polyps.

Fig. 8. *Asteractis expansa*. Polyp as seen expanded in a narrow glass vessel.

Fig. 9. *Bunodosoma granulifera*. Living expanded polyp.

PLATE III.

Fig. 10. *Bunodosoma spherulata*. Enlarged preserved polyp.

Fig. 11. *Aiptasia annulata*. Living expanded polyp.

Fig. 12. *Calliactis tricolor*. Living expanded polyp.

Fig. 13. *Phymanthus crucifer*. Living expanded polyp.

PLATE IV.

Fig. 14. *Zoanthus pulchellus*. Vertical section through the upper part of the column-wall, displaying the double mesoglœal sphincter muscle. Other details are omitted.

Fig. 15. *Zoanthus sociatus*. Vertical section through the upper part of the column-wall, displaying only the double mesoglœal sphincter muscle.

Fig. 16. Transverse section through the stomodæal region of a polyp in which the mesenteries are brachytypic on the left side and macrotypic on the right. At the slight magnification given only the outlines of the mesenteries could be indicated.

PLATE V.

Fig. 17. *Zoanthus sociatus*. Thick longitudinal section through the lower part of the stomodæal wal and along the edge of a complete mesentery. The stomodæal ectoderm is seen to be in continuity with the mesenterial filament along the free edge of the mesentery; the ciliated bands are removed a slight distance from the actual mesenterial border and are seen to be sinuous in sections, the appearance varying in different regions according to the actual direction of the section.

Fig. 18. Transverse section through the free edge of a mesentery a little below the level of the stomodæum. The intermediate streak (*int. st.*) of the mesenterial filament is seen on both sides as a thick layer separating the median glandular streak (*gl. st.*) from the ciliated band (*cil. bd.*); in this particular section the latter is almost covered by the endodermal-like tissues of the intermediate streak.

Fig. 19. Transverse section through the mesenterial filament immediately below the stomodæum. Histologically the tip of the filament very closely resembles the stomodæal ectoderm; the ciliated band (reflected ectoderm) is continued as two wings to the filament, and on the right side is in continuity with the tissue at the tip, while on the left side the continuity is interrupted by the presence of the intermediate tissue.

Fig. 20. Transverse section through a mesentery at the lower part of the stomodæal region. The ciliated band, or reflected ectoderm, extends for some distance up each face of the mesentery, in some parts free and in others in union with the mesenterial tissues. On the lower left-hand side the intermediate tissue in section is overlying the cells of the ciliated band.

Fig. 21. Transverse section through the free edge of a mesentery below the region at which the ciliated streak has terminated. The enlarged median part of the filament is altogether different in histological character from its condition in the uppermost part of its course; elongated granular gland cells and nematocysts are numerous. The mesenterial endoderm behind is also greatly swollen, and contains many deeply staining nutritive particles and gland cells.

Fig. 22. Transverse section through the lower region of the mesentery, showing the last traces of the mesenterial filament. The magnification is much less than in the former figures. The mesenterial epithelium is greatly swollen, nearly surrounding the filament, and is strongly charged with nutritive particles

Plate VI.

Fig. 23. *Isaurus duchassaingi.* Transverse section through the stomodæal region of a polyp, showing the brachytype arrangement of the mesenteries and a large entocœlic outgrowth. At the slight magnification at which the section is drawn only the outlines of the walls can be represented, and the thin part of the mesenteries indicated by a simple line.

Figs. 24, 25. Thick sections through two different polyps, representing the relationships of the smooth and tubercular areas to the directive axis. The directive axis passes through the entocœle of the dorsal microdirectives and the ventral macrodirectives and includes the longer diameter of the stomodæum. In each figure the smooth area is at the upper right hand of the figure. The light areas represent the cut surface, the dark the tubercles projecting below.

Plate VII.

Fig. 26. *Isaurus duchassaingi.* Tangential section through the ectoderm, showing the manner in which it is broken up into subcubical blocks by the intrusion of the mesoglœal strands passing to the subcuticle.

Fig. 27. *Protopalythoa variabilis.* Vertical section through the upper part of a strongly retracted polyp, including the tentacles, disk, and upper part of stomodæal wall. Only the details of the single mesoglœal sphincter muscle and foreign incrustations in the column-wall and disk are represented.

Plate VIII.

Fig. 28. *Palythoa caribæa.* Vertical section through the upper part of a strongly retracted polyp, representing the single mesoglœal sphincter muscle. All the other structural details are omitted.

Fig. 29. *Asteractis expansa.* Section through one-half of a polyp, showing the stomodæal wall, oral disk, tentacle, sphincter muscle (*sp. m.*), acrorhagus (*ac. r.*), parieto-basilar (*p. b. m.*) and basilar muscle (*b. m.*), and inner and outer stomata. The mesentery is viewed on its exocœlic face.

Fig. 30. Vertical section through the upper part of the column-wall, including an acrorhagus, the circumscribed endodermal sphincter muscle (*sp. m.*), and the basal part of a tentacle (*t.*).

Fig. 31. Vertical section through a portion of the base, with a mesentery attached bearing the basilar muscle on each side.

Plate IX.

Fig. 32. *Asteractis expansa.* Transverse section of a sextant of a polyp through the lower part of the stomodæal region. Four orders of mesenteries are represented.

Fig. 33. Transverse section through part of the column-wall, including a verruca (*ver.*) opposite a mesenterial entocœle.

Fig. 34. *Bunodosoma granulifera.* Vertical section through the upper part of the column-wall, showing the evaginations (*ev.*), acrorhagus (*acr.*), disk, and the circumscribed endodermal sphincter muscle.

Plate X.

Fig. 35. *Bunodosoma granulifera.* Transverse section of a retracted, strongly fluted tentacle.

Fig. 36. *Bunodosoma spherulata.* Vertical section through the upper part of the column-wall, including an evagination (*ev.*), acrorhagus, and tentacle (cut obliquely), and showing the small pedunculated, circumscribed endodermal sphincter muscle.

Fig. 37. Vertical section through a portion of the base, showing the basilar muscle on each side of a mesentery.

Fig. 38. Transverse section through a mesenterial filament of the third cycle of mesenteries.

PLATE XI.

Fig. 39. *Bunodosoma spherulata.* Transverse section of a portion of the column-wall some distance below the stomodæal region, with a mesentery attached showing the circumscribed retractor muscle, the parieto-basilar muscle, and the simple filament.

Fig. 40. Transverse section of a polyp toward the termination of the stomodæum, indicating the sequence in which the pairs of the second order of mesenteries become free from the stomodæum.

Fig. 41. *Aiptasia annulata.* Oblique section through an expanded tentacle, showing the ectodermal thickenings (batteries of nematoblasts) and the distribution of the zooxanthellæ within restricted swollen regions of the endoderm.

Fig. 42. Vertical section through the middle region of the column-wall.

PLATE XII.

Fig. 43. *Aiptasia annulata.* Transverse section through the stomodæal region of a polyp. Four cycles of mesenteries are present, but only four bilateral pairs (Edwardsian mesenteries) are complete; the fifth and sixth developmental pairs are incomplete. All the incomplete mesenteries are gonad bearing.

Fig. 44. Transverse section through a trilobed mesenterial filament. The intermediate streak (*int. st.*) between the glandular streak and the ciliated band is of considerable extent and contains many zooxanthellæ.

Fig. 45. *Calliactis tricolor.* Vertical section through the upper part of the column-wall, showing the mesoglœal sphincter muscle.

Fig. 46. Vertical section through a portion of the basal wall, showing the weak basilar muscle on each side of a mesentery.

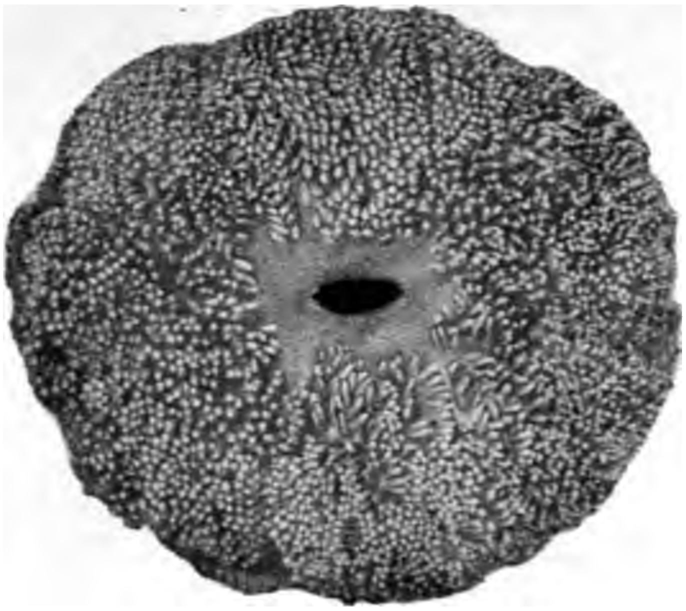

Fig. 1a.

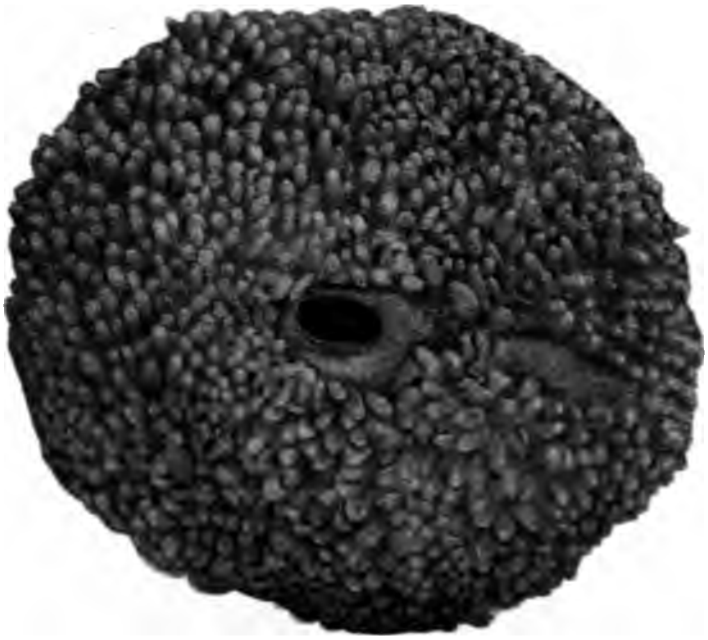

Fig. 1b.

A. HOEN & CO. LITHOCAUSTIC BALTIMORE.

PLATE II.

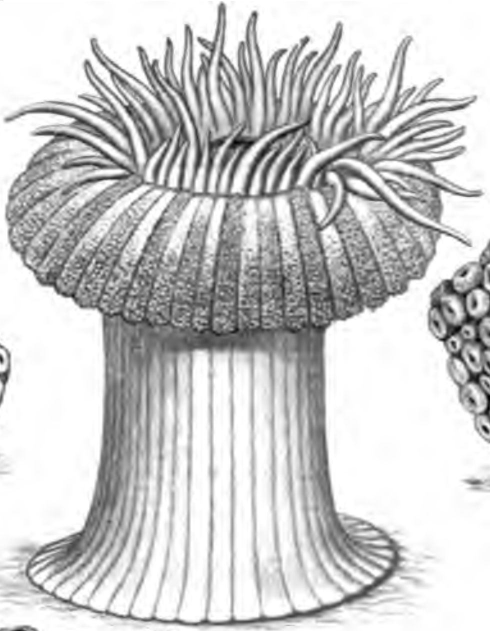

FIG. 8.

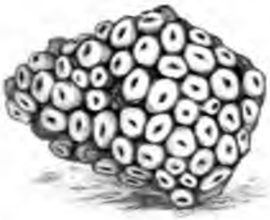

FIG. 3.

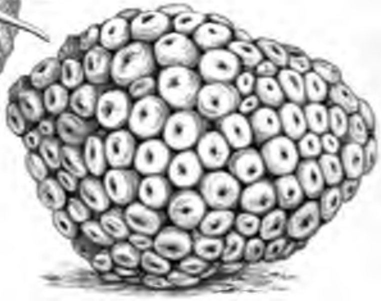

FIG. 2.

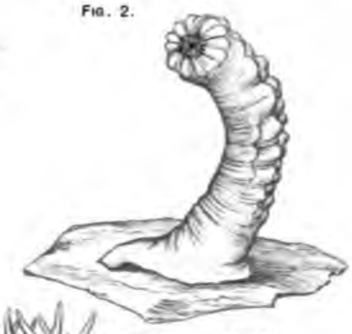

FIG. 5.

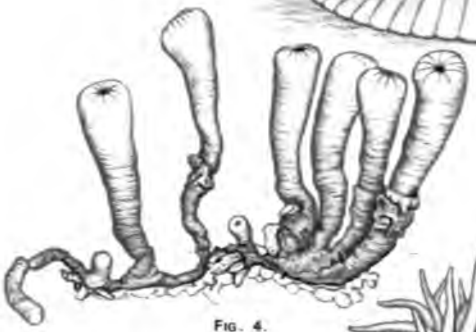

FIG. 4.

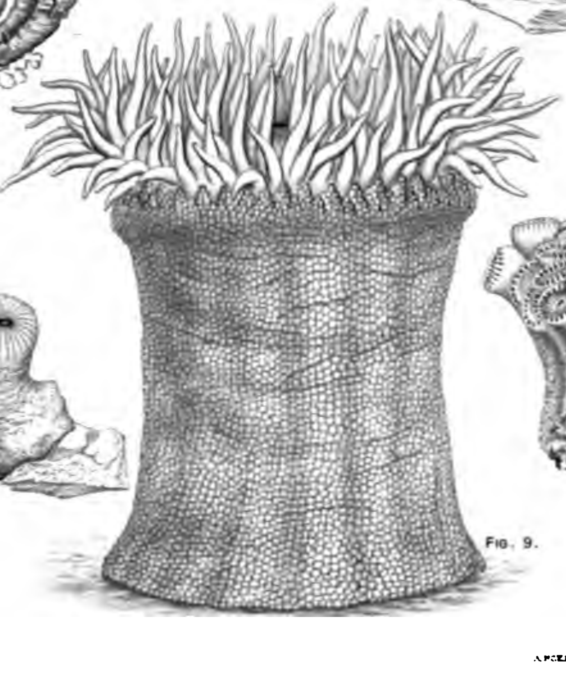

FIG. 9.

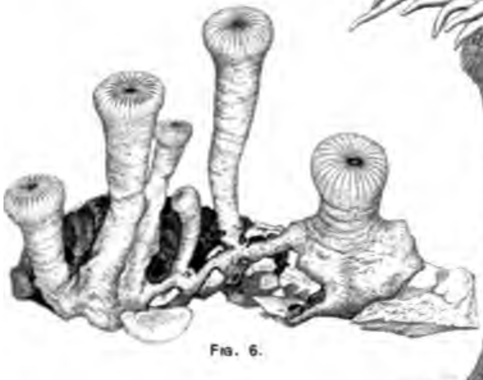

FIG. 6.

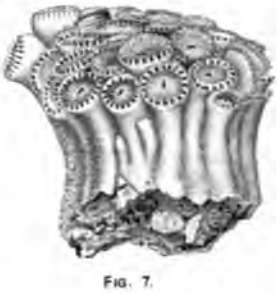

FIG. 7.

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PLATE III.

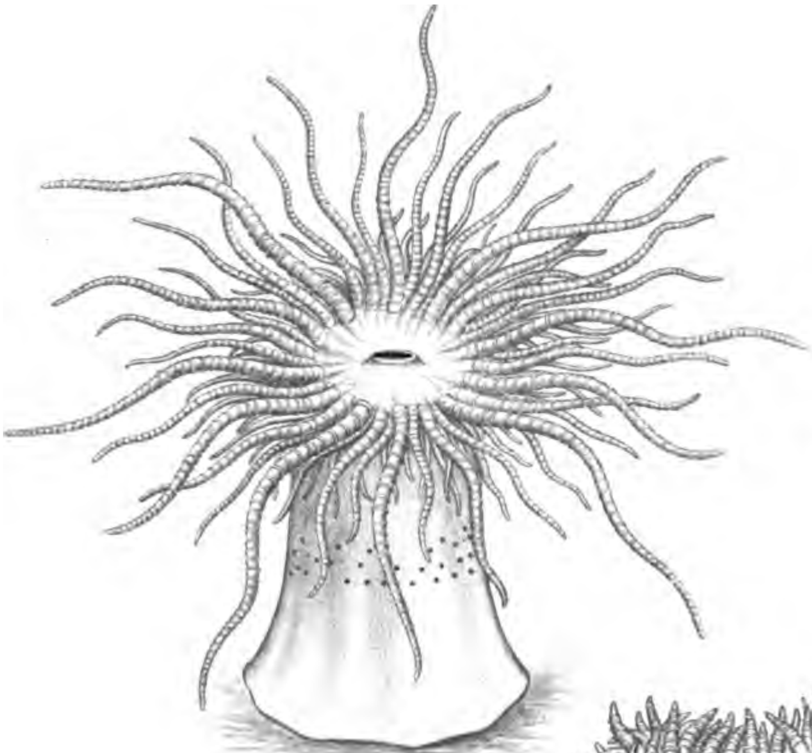

FIG. 11.

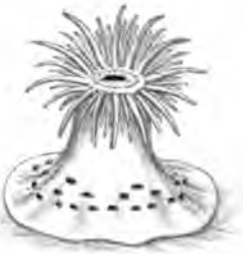

FIG. 12.

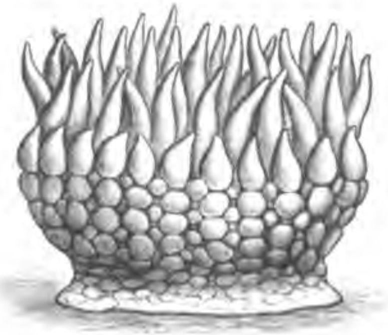

FIG. 10.

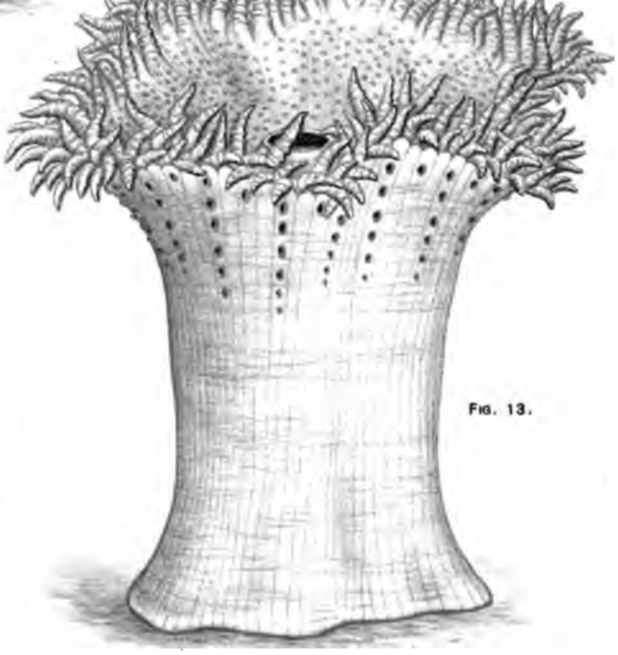

FIG. 13.

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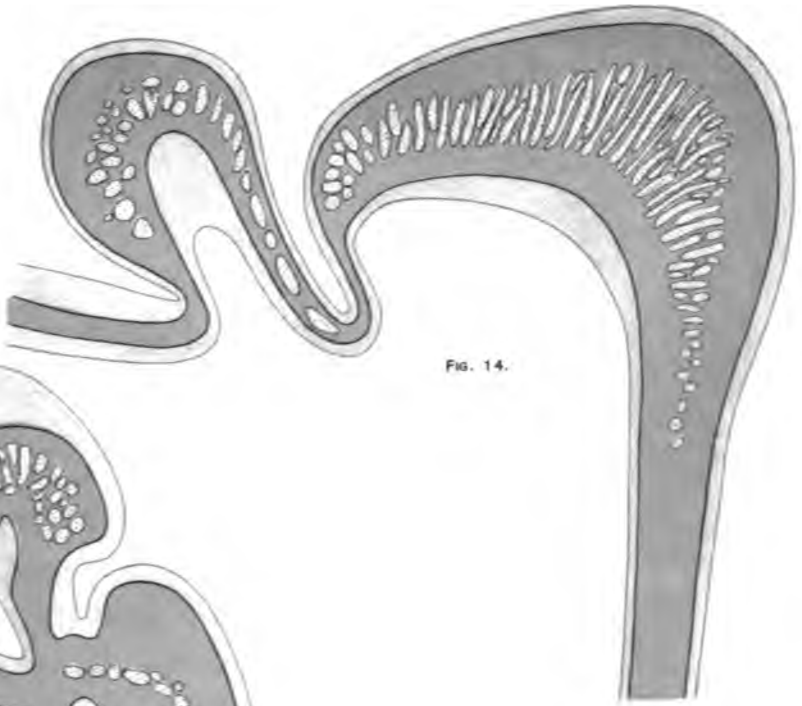

FIG. 14.

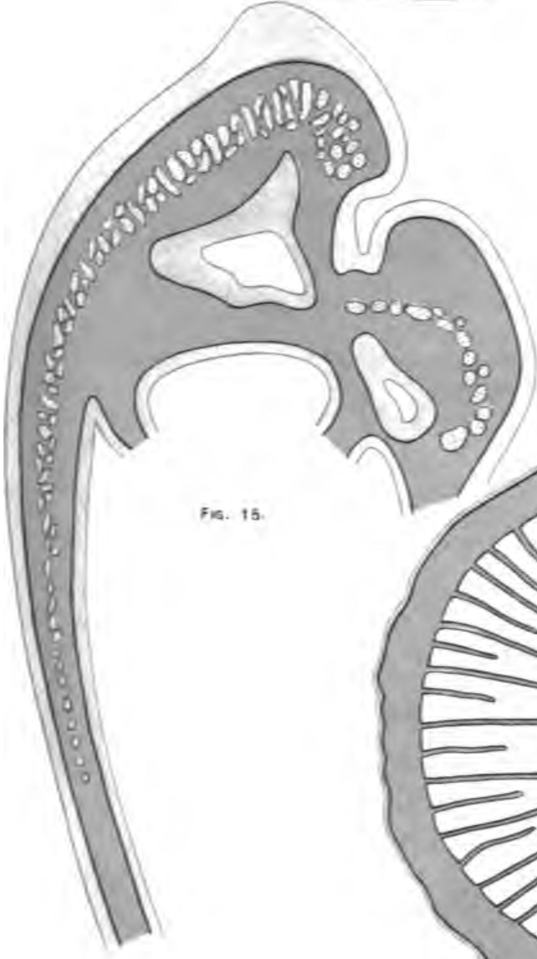

FIG. 15.

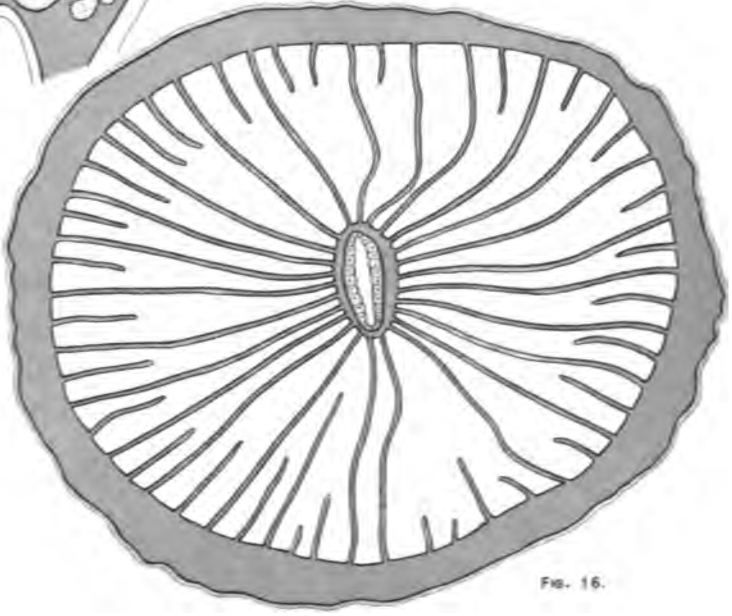

FIG. 16.

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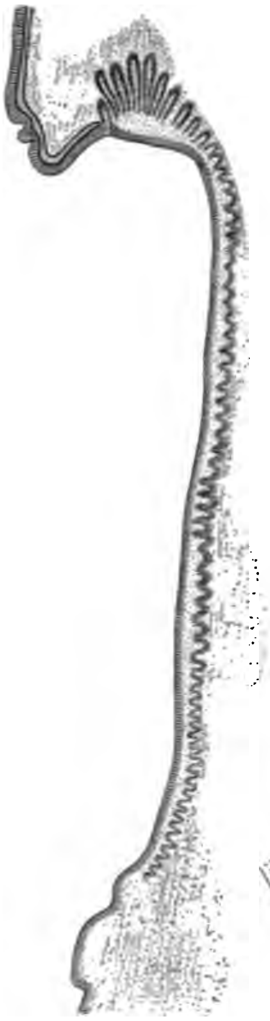

FIG. 17.

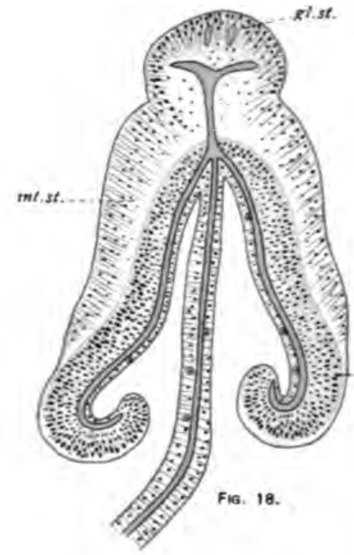

FIG. 18.

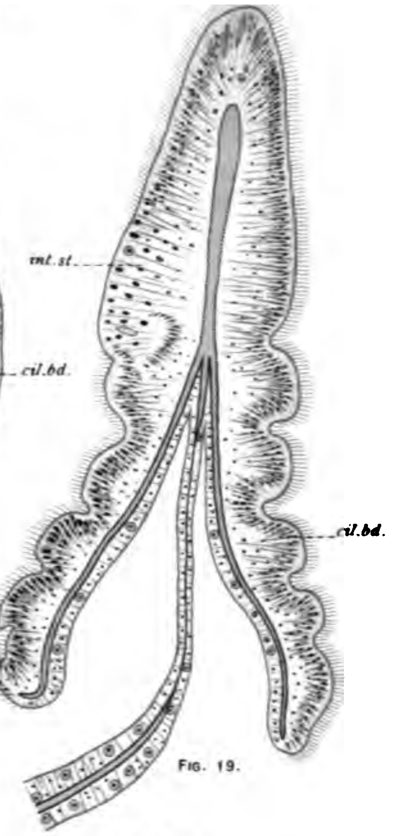

FIG. 19.

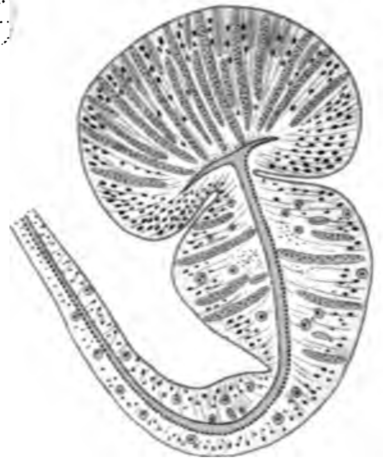

FIG. 21.

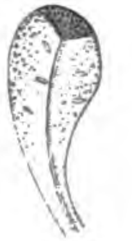

FIG. 22.

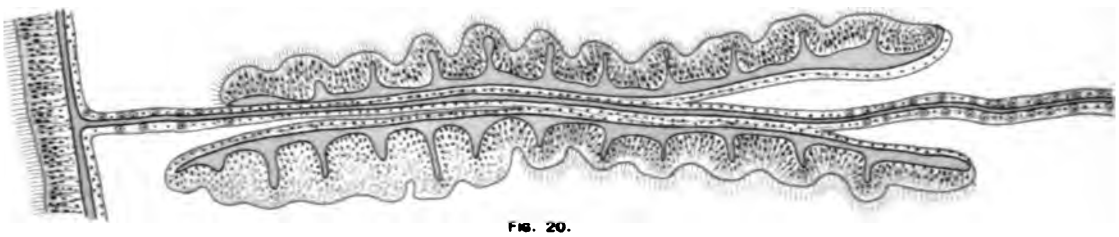

FIG. 20.

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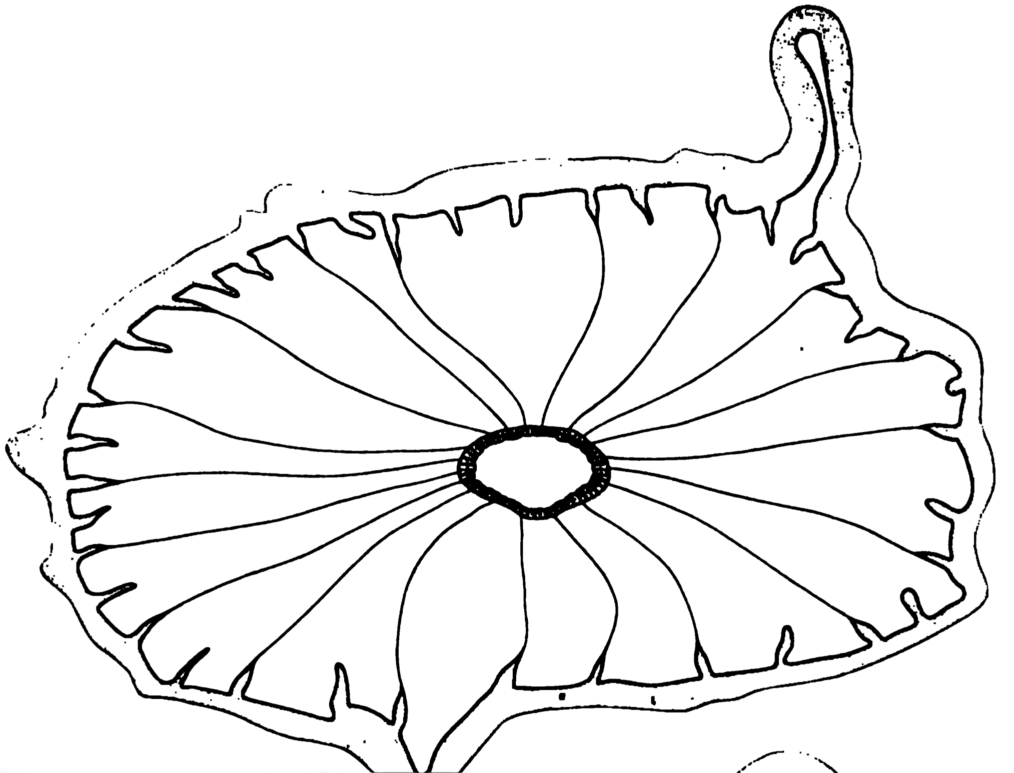

FIG. 23.

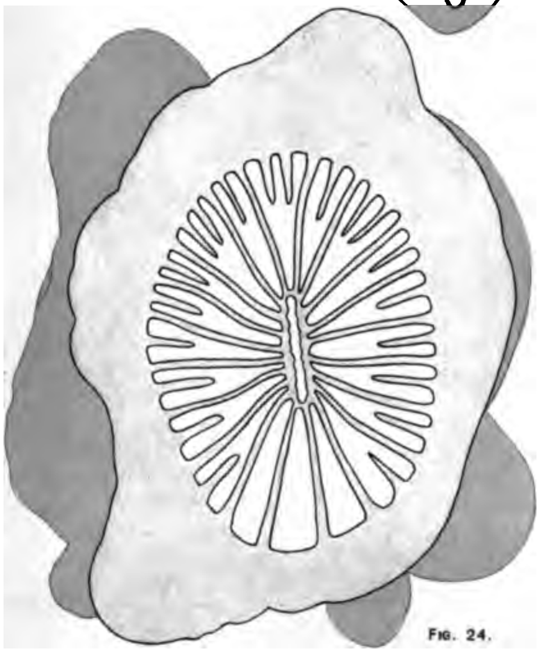

FIG. 24.

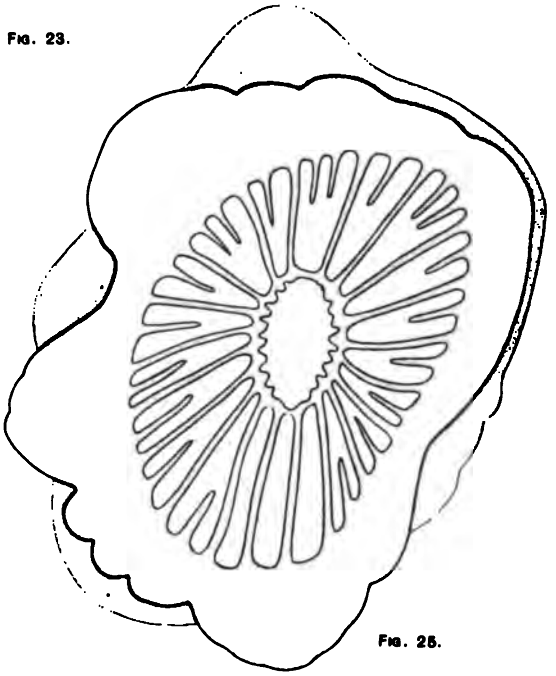

FIG. 25.

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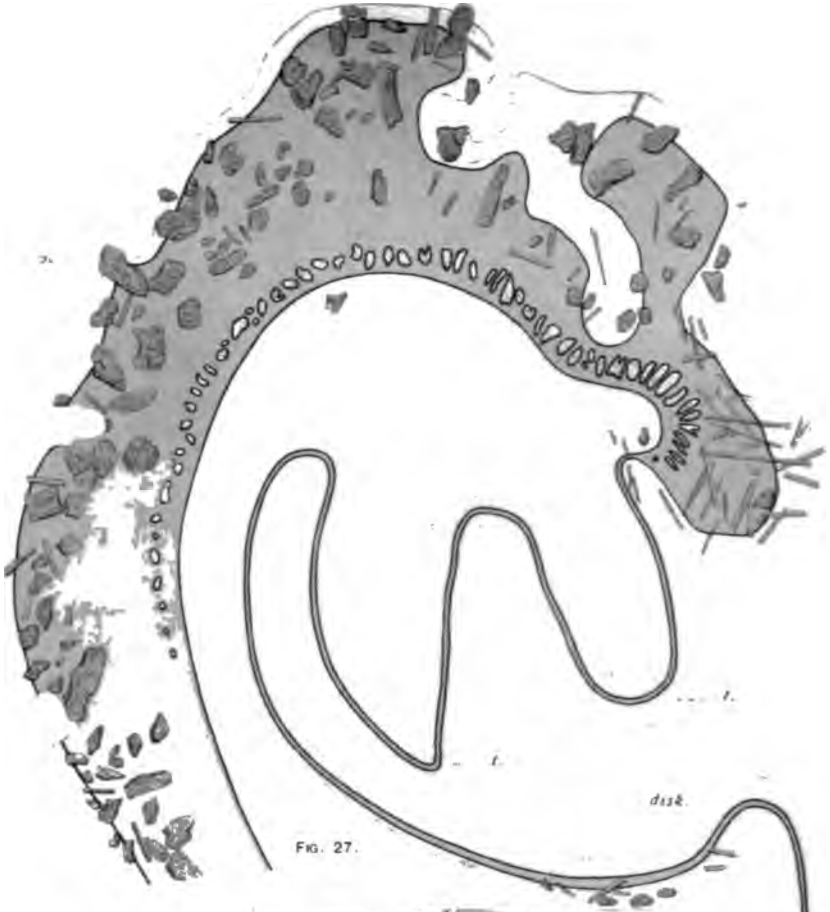

FIG. 27.

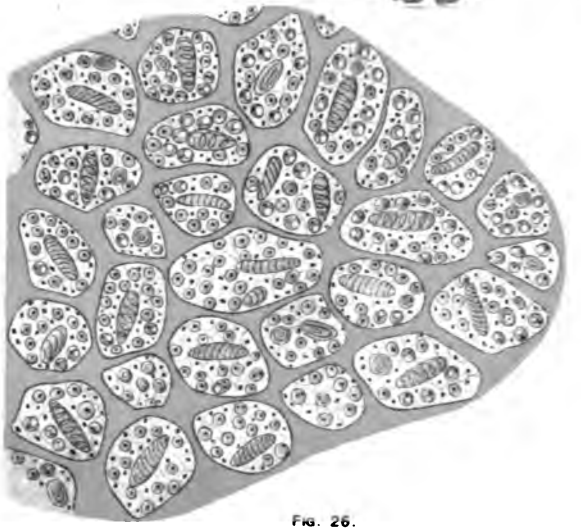

FIG. 26.

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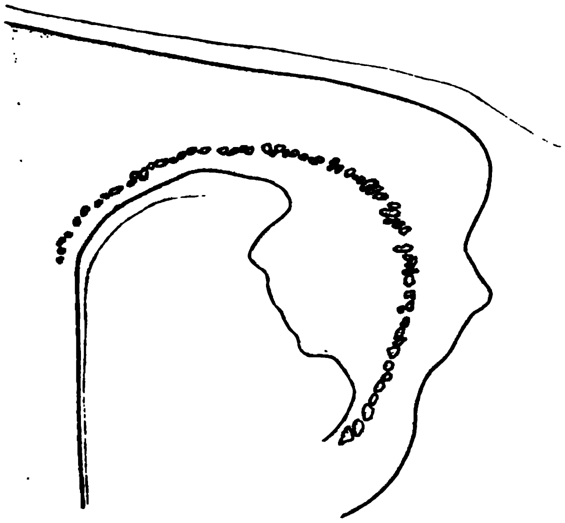

FIG. 28.

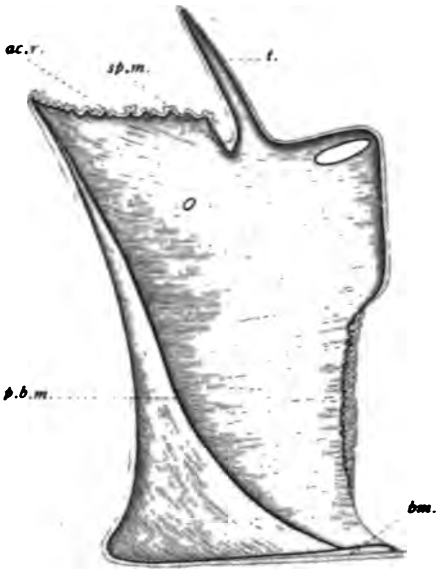

FIG. 29.

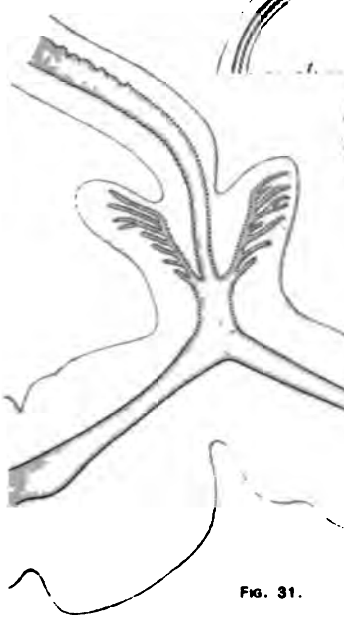

FIG. 31.

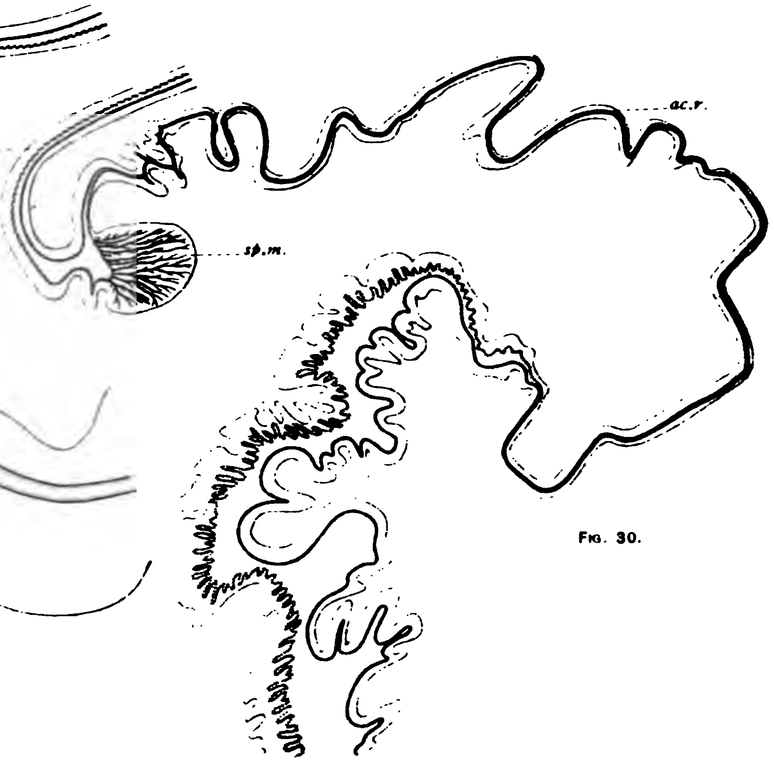

FIG. 30.

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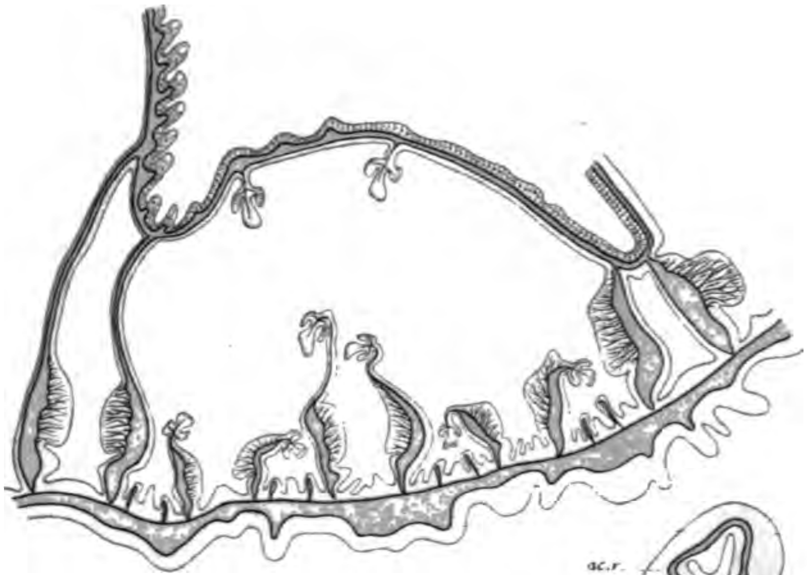

FIG. 32.

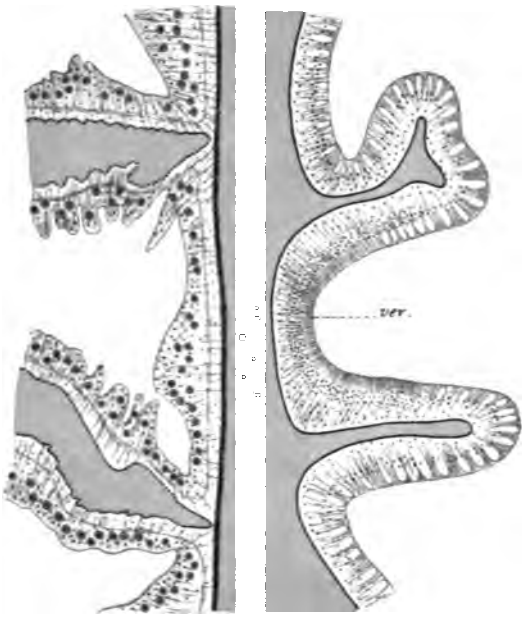

FIG. 33.

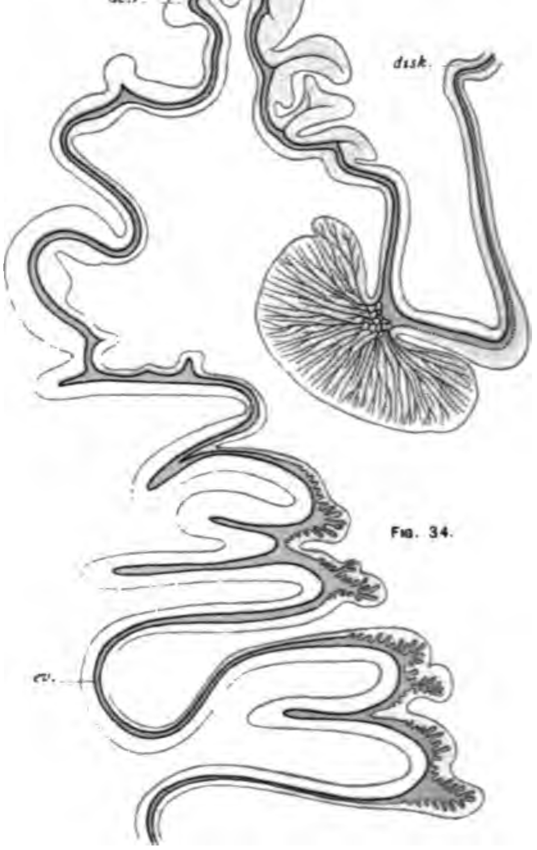

FIG. 34.

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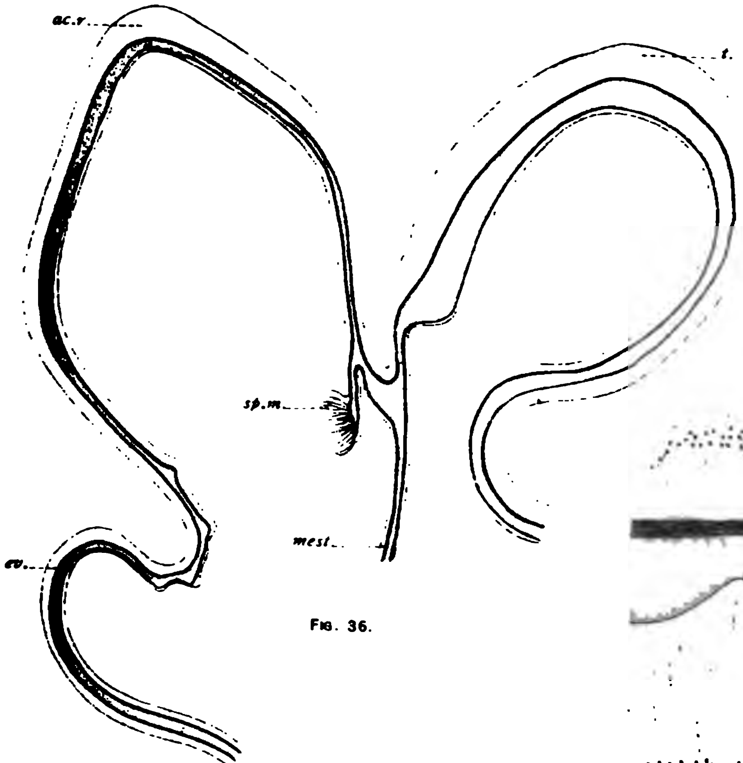

FIG. 36.

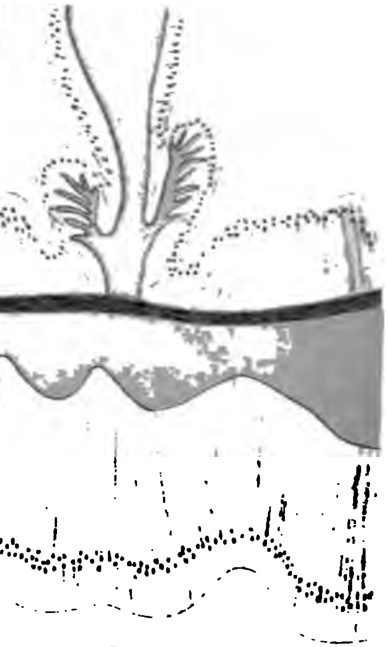

FIG. 37.

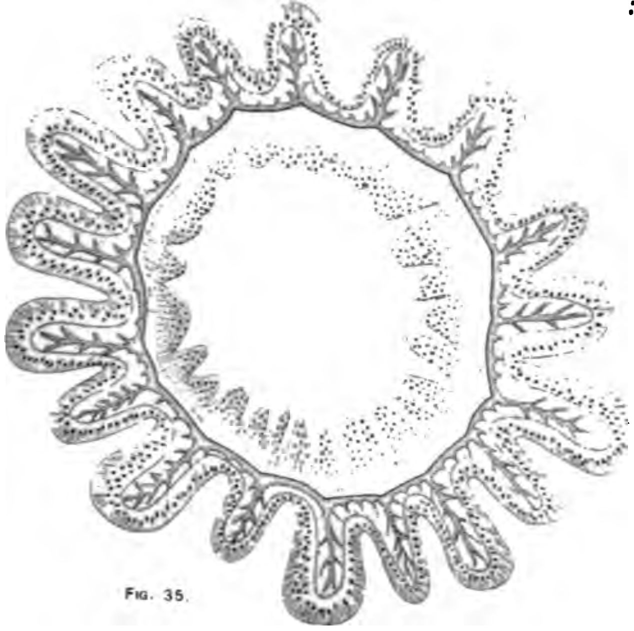

FIG. 35.

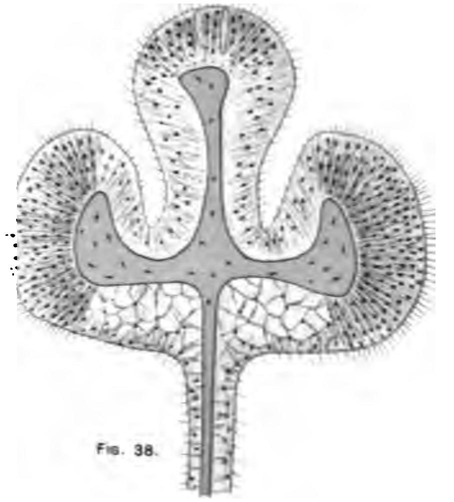

FIG. 38.

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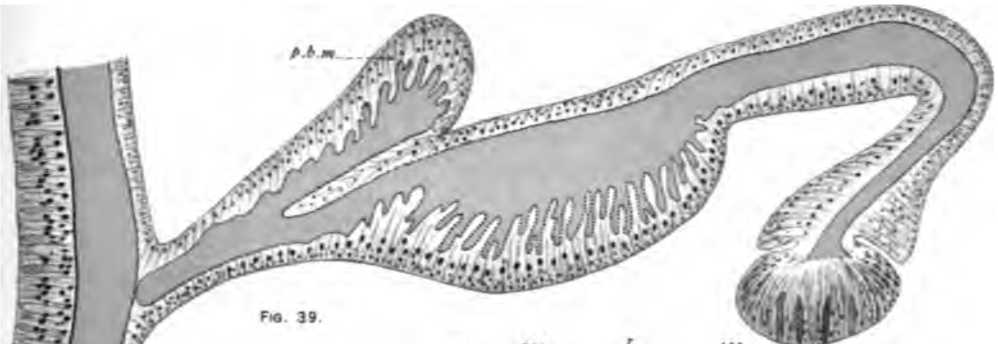

FIG. 39.

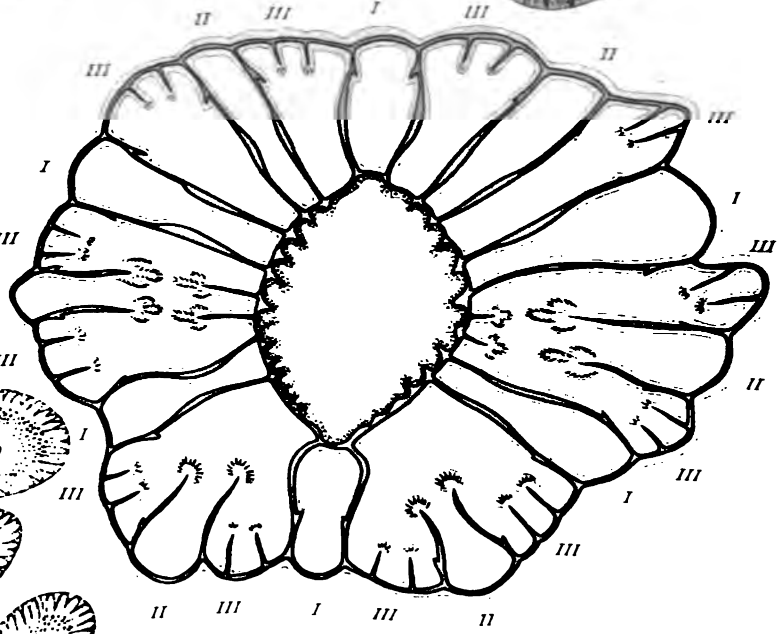

FIG. 40.

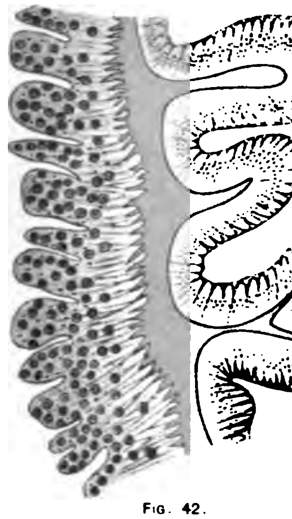

FIG. 42.

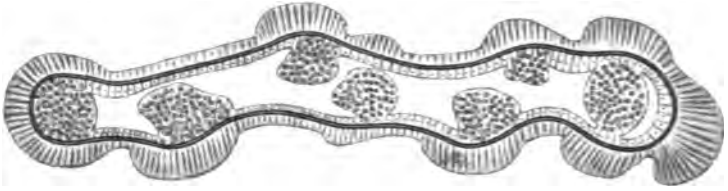

FIG. 41

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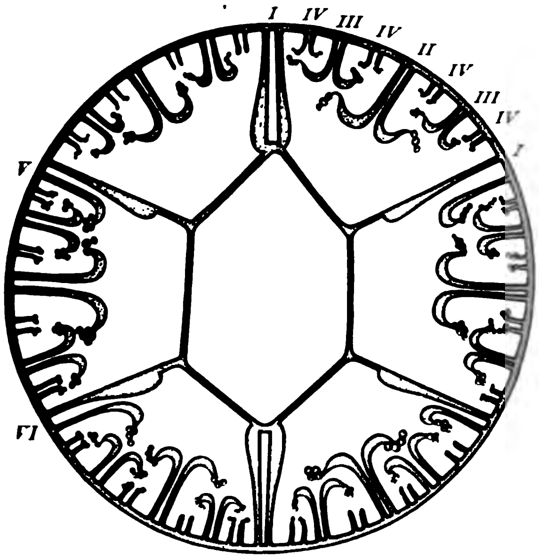


FIG. 43.

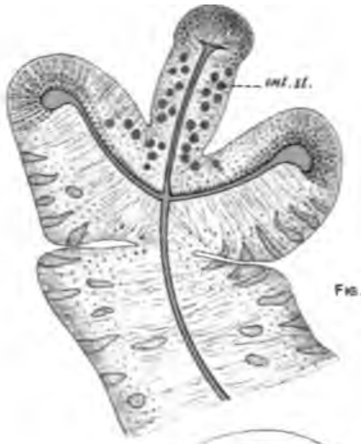
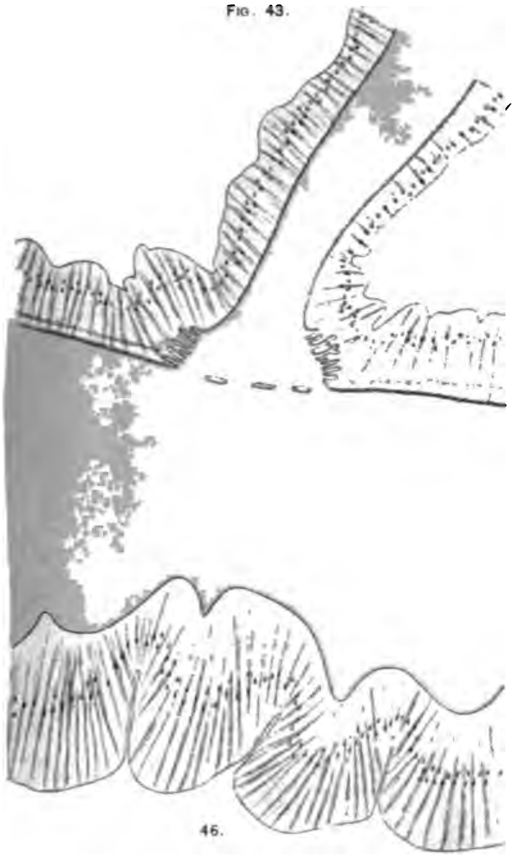
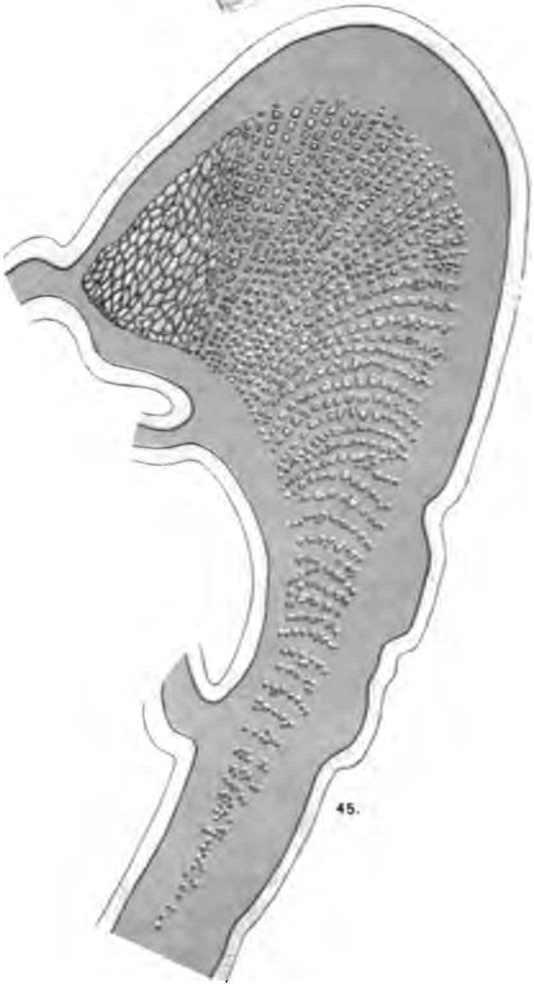


FIG. 44.



46.



45.

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THE SPONGES COLLECTED IN PORTO RICO IN 1899 BY THE U. S. FISH COMMISSION STEAMER FISH HAWK.

BY

H. V. WILSON,
Professor of Biology in the University of North Carolina.

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The following report has been put, at the request of the Commission, in such shape that it may be used for the identification of forms by those unprovided with the special literature bearing on the different species. Some description of each species, whether known or new, is therefore given. The descriptions in all cases apply particularly to the collection specimens. It has seemed unnecessary to give complete lists of the synonymy. Under each species reference is made to the memoir containing the original description. The additional references are to works in which important redescriptions have been given, and which for the most part are readily accessible.

It is needless to dilate on the limitations imposed on one who undertakes to describe a collection of sponges. The histological condition of the material is, of necessity, very poor. Many specimens are broken; and frequently a species is represented by but a single specimen. Species founded on such data are, of course, provisional. Subsequent study of the animals in their habitat, particularly observations on the individual differences due to mere locality, age, or regularly recurring physiological condition (for example, alteration in the surface associated with the closing and opening of pores and oscula), will naturally lead to a more precise conception of the systematic position of those forms, of which the collection specimens are examples.

The question whether a specimen or two, differing in certain respects from a described species (itself frequently based on a study of a very small number of preserved specimens), is to be recorded as a new species or as a variety is one as familiar as vexing. Where in the sponges the difference is one of shape only (as in the cases of *Pilochrota fibrosa* var. *globulariformis*, p. 385, or *Aplysina flagelliformis* var. *anomala*, p. 407), even though this difference be a very considerable one, there can be no doubt that it is right to group the differing forms as varieties, round a type form having the same skeletal elements and arrangement, canal system, and histological structure; or indeed to merge them in the type. Where, as for instance in the case of *Hircinia fœtida* var. *cuspidata* (p. 406), the differences are slight but definite, and concern various parts of the anatomy, the question becomes more complex and is obviously one that must be decided in each particular case from the standpoint of expediency. In cases of this sort, where we do not know whether the individual peculiarities are inheritable, and thus racially distinctive, or whether the offspring of the "varying" forms start afresh on the same footing with those of the type, the term *variety* clearly can have no precise meaning. This fact does not, however, do away with its practical value as an index of slight differences—differences so slight as to make it probable that the forms exhibiting them intergrade and interbreed, or would interbreed, with the type.

Microscopic sections sufficiently good to show the plan of the canal system (in particular the size, shape, and connection with exhalent cavities, of the flagellated chambers) are *necessary* for the diagnosis of most horny and calcareous sponges; less necessary for the silicious forms.

For the study of the skeleton: (1) It is sometimes necessary to bisect the whole sponge in order to learn the relative arrangement of internal and peripheral portions. (2) The arrangement of spicules, spiculo-fiber, or horny fiber, may best be learned from thick sections. These may conveniently be cut free-hand after a very short imbedding in paraffin. *Warm* turpentine dissolves the paraffin very quickly, and the sections may be mounted in balsam. (3) For the demonstration of horny matter where scanty (as in certain chalinine sponges) and for the study of *Hircinia* filaments, glycerin preparations are far superior to balsam ones. (4) In the case of the horny sponges it is advisable to prepare macerated skeletons as well as sections. Warm carefully a piece of sponge or a thick slice in caustic potash, not allowing fluid to boil. Leave in the fluid until the skeleton can be cleaned by gently squirting upon it with pipette. (5) In the case of silicious sponges the arrangement of the skeleton may often be learned in a somewhat similar way. Warm a thick slice in potash, not allowing the slice to disintegrate; compress between slide and cover, admitting fresh water into the space until the skeleton has been cleared of the macerated débris. (6) Surface preparations of the ectosome are usually necessary; surface layer may be stripped or sliced off. (7) For a study of the individual megascleres it is only necessary to boil a bit of sponge in potash, wash, and examine the sediment. Microscleres are often overlooked in this way. For the microscleres a small piece may be boiled on the slide, though I prefer to make a section, or dehydrate and soak in clove oil a fragment, teasing it then on the slide and mounting in balsam.

Unless special mention is made, measurements of spicules given are the average maximum measurements, the diameter given being the greatest diameter of spicule. Colors mentioned are those of alcoholic specimens.

Stations at which sponges were obtained.

Station No.	Locality and exact position. (All compass bearings magnetic.)	Depth (fms.).	Bottom.	Dredging instruments used.
6056	Off Aguadilla, Punta de Borinquen light-house NE. ¼ E. 3¼ miles	48	Sand, mud, shells.	Dredge.
6063	Mayaguez Harbor, Punta del Algarrobo E. 2¾ miles	75 to 76	Rocky, sand, and coral.	11-foot beam trawl.
6067	Mayaguez Harbor, Punta del Algarrobo E. by N. ¼ N. 5¾ miles	97 to 120	Coral	Dredge.
6070	Mayaguez Harbor E. ¾ S. 9 miles	220 to 225	Rocky	9-foot beam trawl.
6072	Off Punta de Melones, Cabo Rojo light-house SSE. 5¼ miles	7¼	Coral, sand, shelly.	Tangle.
6075	Boca Prieta, Punta Guaniquilla SSE. 3½ miles	8½	Coral, sand	Do.
6076	Off Gallardo Bank, tangent of Morillos de Cabo Rojo ESE. ¾ E. 9½ miles.	10	do	Do.
6079	Off St. Thomas, Sail Rock W. by N. ¼ N. 6 miles	20 to 23	Coral	Do.
6080	Off St. Thomas, Sail Rock NW. ¼ W. 4 miles	20	do	Dredge.
6088	Off Vieques, Sail Rock NE. ½ N. 10¾ miles	23	do	Tangle.
6090	Off Culebra, Culebritas light-house NNE. 5¾ miles	16	do	Do.
6097	Off Humaçao, village of Hucares N. ¾ W. 5¼ miles	10	do	Do.

In some cases the specimen label did not bear a station number, reference being made to a named locality. A query (?) has been put after *Station* in cases where there was no label or the station number had been effaced.

DEFINITIONS OF SYSTEMATIC TERMS USED IN THIS REPORT.

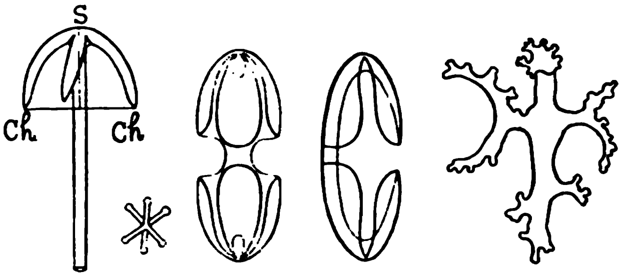
Actine. The ray of a *uniaxial* (*diactinal* or *monactinal*) spicule or of an *aster.*

Anatriæne. A triæne in which the cladi are directed backward. Fig. 1.

Aster. A microsclere in which several rays (actines) proceed from a center or from a longer or shorter axis.

Chela. A microsclere consisting of a more or less curved axial part, the shaft bearing at each end several recurved processes, the teeth. The chela is said to be palmate when the teeth (three at each end) are broad and palm-like, the lateral teeth united with the shaft throughout their length, the median tooth separated from the shaft. Figs. 3, 4.

Chiaster. A minute aster with very slender cylindrical rays, knobbed or not, sometimes truncate, at the ends. Fig. 2.



1. Anatriæne. For lettering, see triæne.
2. Chiaster.
3. Chela, face view.
4. Chela, side view.
5. Desma.

Choanosomal. Said of microscleres restricted to the choanosome.

Choanosome. Vide *ectosome.*

Chord. Vide *triæne.*

Cladome. Vide *triæne.*

Cladostrongyle. A rod-like megasclere rounded off at one end and divided into branches at other.

Cladus. Vide *triæne.*

Collenchyma. A tissue consisting of more or less stellate branching cells, irregularly distributed through a transparent, jelly-like ground substance.

Connective. Vide *secondary fiber.*

Conulus. A more or less conical projection on the surface.

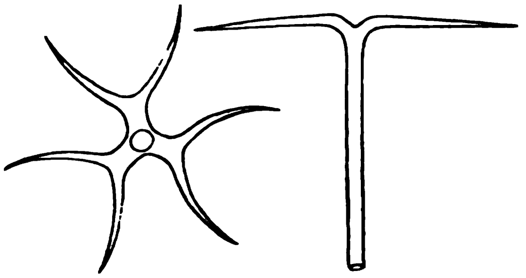
Cortex. An especially differentiated, dense, and more or less fibrous ectosome.

Dermal membrane. A thin membranous ectosome, or the membranous outer layer of the ectosome.

Desma. An irregular, gnarled spicule. Fig. 5.

Deuterocladus. Vide *dichotriæne.*

Diactinal. Term applied to a *uniaxial* spicule in which growth proceeds in opposite directions from the point of origin. Thus, two equivalent and usually similar rays (halves) are produced, the point of origin remaining at or near the middle of the spicule.



6. Dichotriæne, view of the cladome, from above.
7. Orthodiæne.

Dichotriæne. A triæne in which the cladi are dichotomously divided. The undivided part of the cladus is the *protocladus.* The distal divisions are the deuterocladi. Fig. 6.

Ectactine. The centrifugal part of a radially arranged *rhabdus.*

Ectosome. The outer layer of the sponge, not containing flagellated chambers. The rest of the sponge body, containing flagellated chambers, is known as the *choanosome* or *parenchyma.*

Entactine. The centripetal part of a radially arranged *rhabdus.*

Euaster. Comprehensive term applied to asters in which the rays proceed from a center and not from an axis.

Filament. Term applied to the elongated thread-like bodies, of problematical nature, found in species of *Hircinia.* These bodies are 4 to 8 mm. long, very slender, and dilated at the ends.

Isoactinate. When both *actines* of a diactinal spicule are alike in shape and size, the spicule is said to be *isoactinate.*

Isochela. A *chela* in which the two ends are alike and equal. Figs. 3, 4.

Main or primary fiber. A principal fiber of the skeleton, directed radially to the surface or extending longitudinally through the body.

Megasclere. One of the larger spicules which compose the supporting skeleton.

Microsclere. One of the small spicules scattered irregularly through the body in many sponges.

Microxea. A minute oxea.

Monactinal. Term applied to a uniaxial spicule in which growth proceeds in only one direction from the point of origin. Thus only one ray is formed, the point of origin remaining at the end of the spicule, which may or may not be swollen.

Orthodiæne. A reduced orthotriæne in which the cladome includes but two rays. Fig. 7.

Orthotriæne. A triæne in which the cladi make about a right angle with the rhabdome. Fig. 8.

Oxea. A uniaxial spicule gradually pointed at each end. Fig. 9.

Oxyaster. Euaster with small centrum or none, and in which the rays taper to points. Fig. 14.

Oxyhexaster. Hexact, principal rays of which divide into straight or bent terminals, which run out to a point. Fig. 11.

Palmate. Vide *chela.*

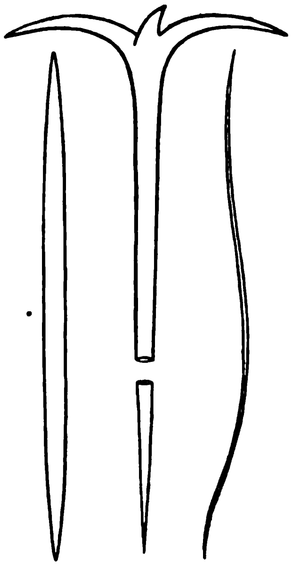
Parenchyma. Vide *ectosome.*

Pentact. Spicule with five rays; a reduced hexact. Fig. 12.

Plagiotriæne. Triæne in which the cladi are directed forward, making an angle of about 45° with the rhabdome produced.

Polyserial. Arranged in several rows.

Primary fiber. Vide *main fiber.*



8. Orthotriæne.
9. Oxea.
10. Rhaphide.

Protocladus. Vide *dichotriæne.*

Protriæne. Triæne in which the cladi are directed forward, making an angle of less than 45° with the rhabdome produced. Fig. 13.

Rhabdome. Shaft of a triæne.

Rhabdus. A rod-like, uniaxial spicule; with like or unlike ends.

Rhaphide. A long hair-like spicule. Fig. 10.

Sagitta. Vide *triæne.*

Sanidaster. Microsclere consisting of a rod-like axis, bearing spines along its whole length. Fig. 15.

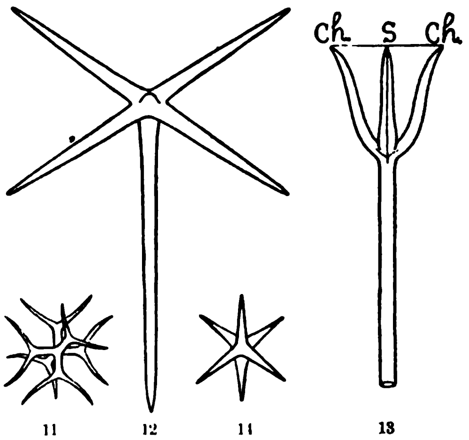
Sclere. Skeletal element or spicule.

Secondary fiber. A fiber extending directly or indirectly (as part of a reticulum) between two main fibers.

Sigma. Microsclere shaped like the letter "*c.*" Fig. 16.

Sigmaspire. A rod-like microsclere spirally twisted. Fig. 17.

Somal. Said of microscleres which are found both in ectosome and choanosome. Such spicules often give the impression of belonging peculiarly to the ectosome.



11. Oxyhexaster.
12. Pentact.
13. Protriæne.
14. Oxyaster.

Sphærohexaster. Hexact, principal rays of which divide into terminals provided with spherical knobs at the ends. Fig. 18.

Spheraster. Euaster in which centrum is large as compared with length of the rays. Figs. 19, 20.

Spherule. A minute microsclere, more or less spherical in form. Fig. 21.

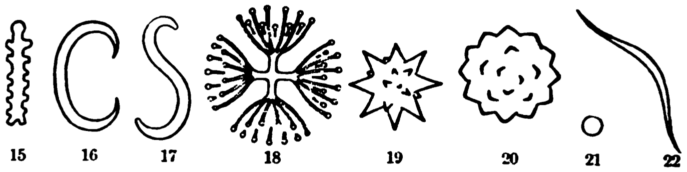
Spiculo-fiber. Tract of uniaxial spicules united by spongin to form a fiber, becoming, when spicules are reduced in number, a horny fiber containing spicules.

Spiraster. Microsclere consisting of a spirally bent axis, bearing spines on its outer surface. Fig. 25.

Spongin. The horny material uniting spicules together, or (as in the Keratosa) constituting the skeleton.

Sterraster. Euaster with numerous rays, which become soldered together. Fig. 23.

Streptaster. A comprehensive term applied to asters in which the rays proceed from an axis, and not from a center.

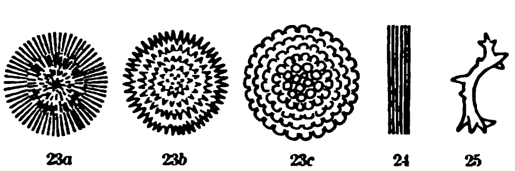


15. Sanidaster.
16. Sigma.
17. Sigmaspire.
18. Sphærohexaster.

19, 20. Two forms of sphæraster.
21. Spherule.
22. Toxa.

Strongyle. A uniaxial spicule in which both ends are rounded, but not swollen. Fig. 27.

Strongyloxea. A uniaxial spicule with one end simply rounded off, the other pointed. Not, in general, distinguishable in shape from the *style* (fig. 28). According to the terminology of Sollas (1888) the term is restricted to diactinal spicules, *style* being used for monactinal spicules of approximately similar shape. But in many cases the "point of origin" of the spicule can not be made out. Where I employ the term it is to facilitate reference to previous important descriptions.



23. Stages in development of Sterraster: *a*, youngest stage; *b*, next condition; *c*, perfect spicule.
24. Trichodragmata.
25. Spiraster.

Style** or **stylus. A uniaxial spicule with one end simply rounded off, the other pointed. Fig. 28.

Subdermal cavity. A comparatively extensive chamber just beneath surface, opening to exterior either directly through the pores or by means of short canals. A peripheral enlargement of the inhalent canal system.

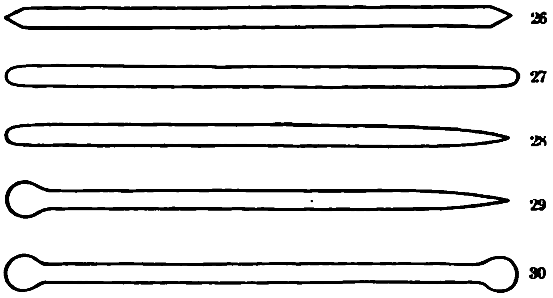
Subtylostylus. A *tylostylus* in which the enlargement at one end (head) is very slight.

Tetraxon. Spicule in which the rays develop along four axes.

Tornote. A uniaxial spicule in which both ends are abruptly pointed. Fig. 26.

Toxa. A bow-shaped microsclere. Fig. 22.

Triæne. A *tetraxon* in which a ray, distinguished as the *shaft* or *rhabdome*, bears at one end three other rays, the *cladi*. The *cladi* together constitute the *cladome*. Forms of the *triæne* are shown in figs. 1, 8, 13. Distance between the ends of two cladi is the *chord*, *ch.*—*ch.* in figs. 1 and 13. Perpendicular distance from the origin of the *cladome* (point where cladi spring from rhabdome) to the *chord* is the *sagitta* (line *s* in figs. 1 and 13).



26. Tornote.
27. Strongyle.
28. Style.
29. Tylostylus.
30. Tylote.

Trichodragmata. Hair-like spicules in bundles. Fig. 24.

Tylostylus. A uniaxial spicule pointed at one end, swollen at the other. Fig. 29.

Tylote. A uniaxial spicule swollen at both ends. Fig. 30. *Used as an adjective* with respect to any spicule ray, it implies that the ray is swollen or knobbed at the end.

Uniaxial. Term applied to a spicule in which growth proceeds along only one axis. Spicule (*monaxon*) is thus rod-like, though it may be straight, or somewhat curved, or even bent. Figs. 9, 10, 26, 27, 28, 29, 30.

Uniserial. Arranged in one row.

Class I. CALCAREA Bowerbank.

Order HETEROCŒLA Poléjaeff.

With flagellated chambers, remaining parts of inner surface covered with pavement epithelium.

Family LEUCONIDÆ (LEUCONES) Hæckel.

The usually round flagellated chambers communicate with the central cavity by means of exhalent canals. Spicules irregularly scattered.

Genus PERICHARAX Poléjaeff (1883).

With distinct subdermal cavities.

Pericharax carteri var. **homoraphis**, Poléjaeff.

Pericharax carteri var. *homoraphis*, Poléjaeff, 1883, p. 6, pl. II, fig. 5; pl. VII, fig. 8.

Station 6090, seven specimens; station ?, two specimens.

Sizes range from a greatest length of 25 mm. to one of 10 mm. Variety of shape exhibited is interesting. A tubular or vase-like shape, expanded above, tapering below into peduncle-like portion, and with a single terminal osculum, is represented. The vase may be very low and wide; may be especially expanded above, and furnished with two oscula at the upper end; or the body may be of a massive, somewhat flattened character, with an osculum on upper surface and another at the margin. In a specimen of the massive shape one surface is convex, the other concave, with the appearance of having been attached; one osculum at the margin.

Color.—Specimens from station 6090, a fairly dark brown; those from station ?, very light brown.

Skeleton.—(1) Regular gastric quadriradiate spicules; facial rays straight, smooth, sharp-pointed, about 150 μ long; apical ray, sharp-pointed, straight or curved, often irregularly bent, sometimes rudimentary, usually 200 to 250 μ long. (2) Triradiate spicules of parenchyma differing from quadriradiates only in absence of fourth ray. Among them are scattered very large (similar) triradiates with rays sometimes exceeding 1 mm. in length; connected with smaller triradiates by intermediate stages. (3) Dermal and subdermal triradiate spicules, similar to the smaller triradiates of parenchyma (in var. *heteroraphis* becoming sagittal and irregular).

Class II. NON-CALCAREA Vosmaer.

Subclass I. TRIAXONIA F. E. Schulze.

Order HEXACTINELLIDA O. Schmidt.

With silicious spicules belonging to the triaxial type, or readily derivable from it.

Family MÆANDROSPONGIDÆ Zittel.

Dictyonine hexactinellida (i. e., having the large parenchymal hexacts united in a firmly connected framework). Body consists of a connected system of labyrinthine anastomosing tubes, between which there is a connected interstitial system of intercanals.

Genus MARGARITELLA O. Schmidt (1880).

With the single species.

Margaritella cœloptychioides O. Schmidt.

Margaritella cœloptychioides, Schmidt, 1880, p. 54, pl. VII, fig. 7.
Margaritella cœloptychioides, Schulze, 1887, p. 351, pl. CI, figs. 3-8.

Station 6056, nine fragments, all flattened pieces about 10 mm. thick, the largest 60 mm. wide.

Only fragments have been seen. From these O. Schmidt inferred that the body has a shallow cup-like form. The intercanals are commonly of a cylindrical shape, but externally are more or less united so as to give rise to the mæandriform furrows seen on outer surface of the sponge. The furrows or separate intercanals are covered in by a delicate dermal membrane perforated by pores and supported by a reticulum composed of the tangential rays of dermal pentacts. The projecting rounded ridges also seen on outer surface, between the furrows, are perforated by numerous small apertures. On the inner (gastral) surface of the sponge are the mostly separate, rounded or elongate, sometimes confluent, apertures of the efferent canals, which extend out into the above-mentioned ridges.

Skeleton.—Meshes of dictyonal framework mostly triangular; beams covered with fine tubercles; nodes not thickened; slender tubercle-like bosses projecting freely on the bounding surface. Dermal membrane contains roughened pentacts; tangential rays usually somewhat dilated at the end, forming a supporting meshwork; proximal radial ray tapering, often no longer, or even shorter, than tangential rays, in other cases longer (as in Schulze's diagnosis). Very similar but smaller pentacts are arranged round the canals, the tangential rays lying in the canal wall, radial ray extending away from the canal longer than the others.

In the parenchyma are found: (1) Oxyhexasters, delicate, variable spicules; terminals, of which there may be two, three, or four, somewhat undulating; some of the principal rays occasionally undivided. (2) Sphærohexasters of variable size and with a variable number of terminal rays.

Subclass II. DEMOSPONGIÆ Sollas.

Order I. TETRACTINELLIDA Marshall.

Some or all of the scleres are tetraxons, triænes, or desmas.

Suborder CHORISTIDA Sollas.

Without desmas. Megascleres not articulated to form a coherent skeleton.

Family TETILLIDÆ Sollas.

Characteristic megasclere is a protriæne. Microscleres when present are sigmaspires, but the sigmaspires are not infrequently absent.

Genus CHROTELLA Sollas (1886, 1888).

Ectosome is a cortex, excavated by subdermal cavities, and furnished with tangentially disposed spicules.

Chrotella minuta, n. sp.

Station 6070, one specimen.

Sponge body ovoidal, colorless, 6 mm. long by 5 mm. wide, with thickness of 4 mm., somewhat flattened on what is probably the under surface. Surface covered with small conuli, from which radiating bundles of long and diverging spicules project to a distance of 800 to 1,600 μ. Cortex, about 500 μ thick and very translucent, is occupied by a single layer of rounded subdermal spaces, about 300 μ deep, lying between the radiating spicular bundles. Cortex collenchymatous, deepest layer having fibrous appearance, owing to fusiform cells running tangentially. No oscula. Pores, few in number, open into subdermal cavities.

Skeleton.—Megascleres. (1) Oxea fusiform, smooth, 2 to 2.5 mm. by 40 μ; ecactine stouter than esactine. Spicule confined to and fairly abundant in the radial bundles. (2) Protriæne; rhabdome, 2.2 mm. by 24 μ above, tapering to a very slender hair-like termination below; cladi 200 μ by 25 μ at the base, tapering to a point, noticeably incurved at apex; sagitta 160 μ with chord 240 μ; confined to and most abundant spicule in the radial bundles. (3) Anatriæne; rhabdome, 2 mm. by 20 μ just below cladome, then narrowing to diameter of 8 μ, which is preserved close to the fine point; cladi 60 μ in length with chord 110 μ and sagitta 48 μ, to 120 μ in length with chord 220 μ and sagitta 70 μ; cladome with apical prominence; confined to and much the least abundant spicule in the radial bundles. (4) Scattered irregularly and in great abundance throughout choanosome, between the radial bundles, are small smooth isoactinate oxeas about 425 μ by 8 μ. Some of these spicules extend out into the deepest layer of the cortex, where they occupy a tangential or oblique position.

Microscleres. (5) Sigmaspire 12 μ long; abundant in dermal membrane and throughout cortex, especially in wall of subdermal cavities; common, but not abundant throughout choanosome.

The specimen is possibly merely a young form. It is much like *C. simplex* Sollas (Sollas 1888, p. 17, pl. II, figs. 1–4), differing chiefly in the presence of the abundant small oxeas and in the possession of conuli. Less important differences concern the size of the radial spicules and the degree to which they protrude.

Family STELLETIDÆ Sollas.

Megascleres are oxeas and orthotriænes, or plagiotriænes, or dichotriænes, frequently with anatriænes in addition. Microscleres include euasters, but never spirasters nor sterrasters.

Genus PILOCHROTA Sollas (1886, 1888).

"Oscules usually distinct. Pores in sieves leading into radial incurrent canals, which are not constricted on passing through the fibrous layer of the cortex. Ectosome differentiated to form a cortex, which usually consists of a middle collenchymatous layer, an outer thin fibrous layer, and an inner thicker fibrous layer." There is but one form of aster, and this is a chiaster.

Pilochrota variabilis, n. sp.

Station 6079, two specimens; station 6090, three specimens; station ?, ten specimens.

The sponges here described resemble several of Sollas's species (*P. hæckeli*, *P. pachydermata*, *P. purpurea*, *P. lendenfeldi*), but the limitations laid down in Sollas's descriptions (1888) make it impossible to refer my specimens to any of these species.

Body spheroidal, often flattened. One specimen attached by its under surface obliquely to coral; the others free, many with foreign particles adhering to surface. Younger forms occasionally found with short (2 mm. or less in length) slender rhizoids on under surface; such rhizoids being prolongations of soft tissue almost without megascleres. Color in alcohol whitish or purplish-brown. The larger specimens measure mostly 20 to 25 mm. in diameter; the smallest, apparently young forms, 5 to 7 mm. in diameter.

In several of the larger specimens a single large osculum, 2 to 3 mm. diameter, is present, leading into a deep cloaca, on the inner wall of which the apertures of excurrent canals may be seen. Such an osculum may be situated in center of upper surface or nearer one side, then opening obliquely. In the attached specimen one such osculum is present on the side, low down, below the margin, while two other very small oscula, appearing as apertures in smooth membranous areas, are similarly situated. In one of the large specimens there are no oscula, but several smooth membranous areas on the surface. In another of the larger specimens a single small osculum is present in the center of a similar smooth membranous area. Most of the young (small) forms are without oscula, but in two cases a very small osculum is situated in center of upper surface. All oscula are surrounded by a smooth membranous border, narrow in the case of the larger ones. Appearances indicate that oscula may be opened and closed.

Pores of variable size, but easily distinguishable with lens, lying in meshes of the network formed by cladi of the cortical orthotriænes. Surface as seen with lens may be practically smooth and obviously porous, or punctate with minute elevations. Such elevations may be enlarged, appearing as areas of rounded polygonal shape, with pores in channels between—this appearance more obvious to eye than when sponge is examined with lens or objective, since the elevated areas themselves are porous.

Cortex in the larger specimens about 700 μ, in the younger forms only 500 μ thick; fibrous with abundant densely granular cells, often in groups, in the outer half. Numerous subdermal cavities in the deeper portion of cortex form a conspicuous layer. These are connected with short, wide (sometimes rounded) canals, which pass outward, branching near surface (often bifurcating), each branch terminating in a pore.

Skeleton.—Megascleres. (1) Orthotriæne; rhabdome, tapering to a fine often whiplash-like end, 1,350 to 1,700 μ by 12 to 24 μ; cladi 100 to 250 μ (increasing with length of rhabdome), slightly curved outward, then straightening or recurved near tip; center of cladome depressed. (2) Very slender orthotriænes of variable size, probably young stages of the preceding, the cladi directed slightly forward so as to give to the spicule the plagiotriæne character; rhabdome tapering to fine long point. A common size has a rhabdome about 500 by 4 μ, cladi 20 to 24 μ. (3) Anatriæne with depressed apex, rhabdome tapering to point, 1,530 to 2,210 μ by 20 to 24 μ; cladi stout, tapering to sharp point, with length 44 to 84 μ, and sagitta 20 to 80 μ, the sagitta increasing with the length of cladus, as does length of cladus with that of rhabdome. Cladome is thus comparatively shallow or quite deep. (4) Oxea smooth, tapering to sharp points, 1,020 to 1,600 μ by 12 to 16 μ, with much smaller forms of same spicule. (5) Ectosomal oxeas slightly curved, 168 to 200 μ by 6 to 8 μ. Such spicules occur scattered very sparsely through outer part of cortex, arranged vertically to surface and slightly projecting. The variations (many no doubt due to difference in the stage of development) in the size and shape of the megascleres, above indicated, may all be encountered in the same individual.

In the center of the sponge, oxeas (4) are the only megascleres. Spicules (1), (2), (3), (4), all radiate outward from central portion as far as the cortex. Just within cortex the cladi of the orthotriænes may be arranged in conspicuous concentric layers, the larger spicules on the outside. In other specimens this concentric arrangement of the cladi is not conspicuous, the orthotriænes of this region not being abundant, and nearly all comparatively small. From the interior separate spicules or bundles, containing each a few diverging spicules, radiate out through cortex to surface. Such spicules are large orthotriænes (1), accompanied by anatriænes (3), with occasional oxeas (4). Cladomes of the orthotriænes lie just beneath the surface. Anatriænes are frequently found projecting from surface.

Microscleres. (6) Chiasters with a very small centrum or none, the rays very slender, minutely roughened, and somewhat tylote. Choanosomal chiasters have diameter 12 to 16 μ and about 8 rays; somal, diameter 10 to 12 μ and about 12 rays. In some specimens the chiasters are rare throughout the sponge; in other specimens they may be abundant in the cortex and comparatively rare in the interior.

Pilochrota fibrosa (O. Schmidt) Sollas var. **globulariformis**, n. var.

Ancorina fibrosa, Schmidt, 1870, p. 67.
Pilochrota fibrosa, Sollas, 1888, p. 180.

Station 6079, one specimen.

Schmidt (l. c.) gave the name of *Ancorina fibrosa* to a sponge of irregular, incrusting habitus, with a clearly differentiated cortex. Schmidt says the megascleres are similar to those of *A. simplicissima* Schm. In this latter sponge (Schmidt, 1868, p. 18; Taf. III, fig. 9; Taf. IV, fig. 9) are found oxeas, anatriænes (Anker "mit abwärts gekehrten Spitzen"), and plagiotriænes. Sollas (l. c.) examined one of Schmidt's preparations of this sponge and discovered chiasters, also determining size of oxea. He does not, however, in his diagnosis, mention the anatriænes.

The Porto Rico form, although differing in habitus from Schmidt's specimen, agrees with it in the character of its spicules, and must therefore be identified as belonging to the same species. The specimen is spheroidal, 35 mm. in diameter, with one osculum, 4 mm. in diameter, leading into a cloaca-like cavity, into which efferent canals open. Surface uneven and almost completely covered with broken pieces of shell. Color, reddish-brown.

Skeleton.—Megascleres. (1) Oxea 1.43 mm. by 0.027 mm., smooth, tapering to points. (2) Plagiotriænes very abundant; rhabdome about 1 mm. long, 24 μ thick above, becoming very slender below, tapering to fine point; cladi 80 μ long, nearly straight, tapering gradually to a point. Anatriæne not abundant; rhabdome about 1.45 mm. long, 16 μ thick above, becoming very slender below, tapering to fine point; cladi 52 μ long, sagitta 44 μ.

Microscleres. (4) Chiasters are abundant and alike in ectosome and choanosome; total diameter 12 μ; no differentiated centrum; rays tylote, 6 to 12.

Genus TRIBRACHIUM Weltner (1882).

Sponge produced into a special cloacal tube, the megascleres of which are orthodiænes. The characteristic microsclere is a sanidaster.

Tribrachium schmidtii Weltner.

Tribrachium schmidtii, Weltner, 1882.
Tribrachium schmidtii, Sollas, 1888, p. 154, pl. XVII; pl. XLI, fig. 5.

Station 6067, four specimens.

Sponge body is spheroidal, 5 to 8 mm. diameter; cloacal tube 3 to 5 mm. long. The Porto Rico specimens differ from the type as described by Sollas in the character of the somal triænes. These in Sollas's description are orthotriænes, but he mentions that "sometimes one or more cladi are bifurcate" (l. c., p. 154); and in the explanation of fig. 17, pl. XVII, he mentions that dichotriænes occur near the base of the cloacal tube, but not elsewhere. In the Porto Rico specimens the somal triænes are all dichotriænes, but in view of the agreement in other respects with Sollas's description, it does not seem advisable to make a new species on this evidently variable characteristic.

Skeleton.—Megascleres: (1) Oxeas about 2.8 mm. by 34 μ. (2) Somal dichotriænes: Rhabdome about 2.5 mm. by 68 μ above. Cladi stout; protocladus about 150 μ by 68μ; deuterocladus about 170 μ by 50 μ at base, tapering to point; deuterocladi of same spicule not always of same length. Here and there are found dichotriænes with rhabdome much slenderer than in the type; and with cladi longer and also much slenderer than in the type. (3) Cloacal orthodiænes, with rhabdome 2 mm. by 25 μ above; cladi 475 μ long. No anatriænes observed, although such spicules were present in Sollas's specimens.

Microscleres: (4) Sanidasters 12 to 14 μ long, are abundant in parenchyma and very abundant in dermal membrane. (5) Sollas says "oxyasters would appear to be characteristically absent." He, however, observed a single spicule. In the Porto Rico specimens, a few minute and somewhat irregular asters having a total diameter 6 to 8 μ, with a small and variable number of slender rays (chiaster type), are present. In a small percentage of the sanidasters, the actines become fewer in number and longer, while the axis decreases in length. The asters just mentioned are, I think, to be regarded as excessively shortened sanidasters.

Family GEODIIDÆ Gray.

Megascleres include triænes. Characteristic microsclere is a sterraster.

Genus CAMINUS O. Schmidt (1862)

Megascleres are orthotriænes and rhabdi; anatriænes and protriænes absent. Sterraster is spherical, and the somal microsclere a spherule. Osculum leads into a cloaca.

Caminus sphæroconia Sollas.

Caminus sphæroconia, Sollas, 1888, p. 214, pl. XXVII.

Station?, one specimen.

Specimen is massive, obconical, 80 mm. high; two oscula on upper surface.

Skeleton.—Spicules in general somewhat smaller than in Sollas's specimen (from Bahia). Megascleres: (1) Strongyle about 450 to 500 μ by 12 μ. (2) Orthotriæne; rhabdome 240 μ by 8 μ; cladus about 148 μ. Microscleres: (3) Sterraster about 44 μ diameter. (4) Spherule, 4 μ diameter.

Order 2. CARNOSA Topsent.

Sponges without megascleres. Microscleres present or absent; when present, they are asters or 4-rayed spicules.

Suborder OLIGOSILICINA Vosmaer.

Sponges either entirely without skeleton, or with only stellate microscleres.

Family CHONDROSIDÆ F. E. Schulze.

With a fibrous cortex. Flagellated chambers opening by special canaliculi into exhalent cavities. Surface slippery.

Genus CHONDRILLA O. Schmidt (1862).

Bulbous or incrusting sponges with stellate spicules (spherasters associated in some species with oxyasters).

Chondrilla nucula O. Schmidt.

Chondrilla nucula O. Schmidt, 1862, p. 39, pl. III, figs. 22, 22*a*.
Chondrilla nucula F. E. Schulze, 1877, p. 24, Taf. IX.
Chondrilla nucula Lendenfeld, 1896, p. 34, Taf. I, VI, VIII, IX.

Station 6079, two specimens incrusting *Pachychalina amaranthus*.

Skeleton.—Spicules are spherasters, especially abundant in the cortex and accompanying the canals. In the Porto Rico forms (in one and the same individual) there is a considerable variation in the details of shape, as well as in the size, of the spicules. Schmidt, for Mediterranean forms, puts the total diameter at 27 μ, with smaller sizes. Schulze and Lendenfeld, for Mediterranean forms, put the diameter respectively at 10 to 20 μ and 13 to 28 μ. In the Porto Rico specimens the cortical spicules vary but little. Total diameter from ray apex to ray apex is 28 μ or close to it, with a ray length of 6 μ. The spicule resembles that figured by Schmidt, rather than the other extreme present in Schulze's specimens; differing from the latter in having a longer, sharper ray, outline of which is not convex, but is either straight or slightly concave. About nine rays are seen round the edge when the equator of the spicule is brought into focus.

In the interior of the sponge the spicules vary more. Spherasters similar to those of the cortex are abundant, with a ray length 6 to 8 μ. Smaller sizes of same spicule, down to 10 μ diameter, are present. Forms with relatively larger body and shorter rays are also fairly common. In these, total diameter of which is 12 to 20 μ, the rays are mere projections, 2 μ and less in length, on the surface; outline of ray straight or frequently convex. Such spicules resemble those described by Schulze. Intermediate forms between the two extremes are fairly common; total diameter, 28 to 32 μ; ray length, 3 to 4 μ; rays with straight or slightly concave outline.

Order 3. MONAXONIDA Ridley & Dendy.

Silicious sponges in which the megascleres are uniaxial.

Suborder I. HADROMERINA Topsent.

Compact sponges, with skeleton radiately arranged, or without order, rarely forming spiculo-fibers, not reticulated, and usually without spongin. Megascleres, monactinal or diactinal, as a rule of a single kind. Microscleres, when present, some form of aster or microxea, never chelæ or sigmata.

Family COPPATIIDÆ Topsent.

Megascleres diactinal. Body massive, rarely cyathiform. Microscleres absent, or when present euasters with which streptasters may be associated.

Genus COPPATIAS Sollas (1888).

Megascleres arranged partly in radiating fibers, partly scattered loosely in the choanosome; in the ectosome they lie tangentially. Microscleres are euasters.

Coppatias solidissima, n. sp.

Station 6079, two specimens, both fragments.

Both fragments elongated, flattened lobes, about 20 mm. thick and twice as wide, each prolonged above into a slender digitate solid process, rounded at the end. Total length of longest fragment 120 mm. Oscula, few in number, about 3 mm. diameter, all on one side. Consistency firm and hard; surface nearly covered with incrustations. Color: Exterior, dark slate-brown, with tinge of purple; colorless within.

Subdermal cavities fairly well developed. Granular pigment cells (brown), 16 to 20 μ diameter, are scattered through whole body, but are densely crowded in dermal membrane, and internal to it for a varying distance, in places throughout the thickness occupied by the cortical brushes of spicules. Pores, about 40 μ diameter, are grouped, four or five together, in small transparent pore areas, separated by heavily pigmented tissue. The arrangement is such that the pigmented tissue forms a network of trabeculæ. (In this species, as elsewhere, the appearance of the dermal membrane must vary from time to time.)

Skeleton.—Megascleres: (1) Oxea, smooth, somewhat curved, 1 mm. by 28 μ. Smaller sizes, doubtless younger stages of this, the chief, spicule, are common. These large oxeas are arranged: *a*, in radial cortical brushes; *b*, from some of the latter, bundles are prolonged into the interior; *c*, in numerous longitudinal main bundles, which are not very distinctly marked off from one another, the bundle arrangement most distinct in transverse section; *d*, scattered irregularly through the sponge body. The oxea is occasionally found with one rounded end (strongyloxea). It is noteworthy that occasionally a triæne spicule is found properly placed among the cortical oxeas. In looking through a number of preparations, I have seen three such spicules. Their position possibly indicates that they are not foreign. (2) Small smooth oxeas (microxeas Sollas), 60 by 3 μ, are abundant in the dermal membrane, where they are arranged tangentially; also scattered sparsely through interior.

Microscleres: (3) Minute chiasters, 6 μ diameter, incrusting the dermal membrane in great abundance. Similar but somewhat larger chiasters, 8 to 10 μ diameter, are sparsely scattered through interior.

In spiculation this species closely approaches *Coppatias* (*Stelletinopsis*) *purpureus* Carter (Carter 1886, p. 459), from Port Western, South Australia. Carter's description does not include details as to distribution of spicules.

Family TETHYIDÆ Topsent.

Body spheroidal or massive, with radiately arranged skeleton, and a more or less differentiated ectosome. When microscleres are present, the chief microsclere is some form of euaster.

Genus TETHYA Lamarck (1815).

Ectosome differentiated into a well-developed fibrous cortex. Megascleres are fusiform strongyloxeas. Microscleres are euasters of two kinds (spherasters and chiasters).

Tethya seychellensis (E. P. Wright) Sollas.

Alemo seychellensis, E. P. Wright, 1881, p. 13, pl. I.
Tethya seychellensis, Sollas, 1888, p. 427, pl. XLIV, figs. 1–6.

Ensenada Honda, Culebra, one specimen.

Sponge more or less spherical, attached or free, surface conulose, conules sometimes appearing as wide polygonal plates with denticulated margins. Oscules one or more in number; pores in sieves, situated in the depressions between the conules, leading into extensive intercortical cavities (Sollas).

Skeleton.—Megascleres. (1) Large strongyloxeas, 1.2 to 1.5 mm. long, with diameter 20 to 24 μ. Similar smaller spicules of varying size down to 300 by 4 μ are abundant.

Microscleres. (2) Cortical spheraster, 40 μ diameter. (3) Somal chiaster, 8 to 10 μ diameter. (4) Choanosomal aster, with a ray length 20 to 28 μ.

Tethya lyncurium (Lin.) Lamarck.

Tethya lyncurium, Sollas, 1888, p. 435, pl. XLIII, figs. 15-18; pl. XLIV, figs. 17–19.

Playa de Ponce light-house reef, three specimens; Ponce reefs, two specimens.

Body spheroidal, attached. Diameter of specimens 15 to 22 mm.; small oscula present on some, absent on others. Buds on some of the specimens. Outer non-fibrous part of cortex 800 μ, inner fibrous part 650 μ thick.

Skeleton.—Megascleres. (1) Large strongyloxeas, 1.2 mm. by 20 μ to 1.4 mm. by 28 μ; oxeate end rounded, though often quite small. Essentially similar spicules of varying size, down to 340 by 4 μ, are abundant; in the smaller forms the oxeate end is sharp-pointed.

Microscleres. (2) Cortical spheraster, 72 μ diameter. (3) Somal and choanosomal chiaster, 12 to 16 μ diameter.

Genus TUBERELLA Keller (1880).

Without a fibrous cortex, and without microscleres. Chief megascleres are fusiform strongyloxeas, with small strongyloxeas at the periphery.

Tuberella aaptos (O. Schmidt) Topsent.

Ancorina aaptos, O. Schmidt, 1864, p. 33, Taf. IV, fig. 11.
Suberites aaptus, Lendenfeld, 1896, p. 140, Taf. VII, XII.
Tuberella aaptos, Topsent, 1900, p. 285, pl. VIII.

Mayaguez Harbor, one specimen.

Body is massive, higher than broad, 60 by 35 mm., attached below to coral; subdivided above into two short lobes, one with small (nearly closed?) terminal osculum opening into a short axial cavity. Surface smooth or covered with short papillæ. Consistency firm and fleshy. Color: Surface of specimen very dirty; clean parts light brown. In a gross section peripheral layer is slate colored; interior light.

Skeleton.—Strong spiculo-fibers about 0.5 mm. thick course, at oblique angles to vertical axis of body, through interior; breaking up 5 mm. or thereabouts from surface into smaller bundles, which radiate out to the surface. These fibers cross frequently, fusing at the points of intersection, and thus give rise to scattered, sometimes star-like, centers, from which the fibers seem to radiate. The outer smaller radiating bundles frequently (always?) arise from peripherally situated nodal points of this sort. Abundant scattered spicules lie between the fibers and peripheral bundles. At the surface are closely set diverging bundles of small strongyloxeas.

Megascleres. (1) Chief spicule is a smooth fusiform strongyloxea, 1.5 mm. by 40 μ or thereabouts; strongylate end greatly narrowed. Smaller stages in development of the same spicule are found. Occasionally oxeate end is rounded, spicule becoming nearly isoactinate. (2) Strongyloxeas of about same size as (1), not fusiform; with basal end rounded but not narrowed, and with tapering end also rounded at apex; not common. Both (1) and (2) make up the fibers and peripheral bundles, and are also found scattered. (3) Small strongyloxeas, frequently about 300 by 7 μ, with basal end rounded not narrowed, make up the surface brushes; also scattered in interior, together with smaller slenderer forms, probably stages in development of same spicule.

Suborder II. HALICHONDRINA Ridley & Dendy.

Typically noncorticate; skeleton usually reticulate; megascleres usually either oxeas or styles.

Family HOMORRHAPHIDÆ Ridley & Dendy.

Megascleres all diactinal, either oxeas or strongyles; no microscleres.

Subfamily RENIERINÆ Ridley & Dendy.

The spicules may be united together by a small proportion of spongin, but are never completely enveloped in it.

Genus PETROSIA Vosmaer (1885).

Sponge usually hard; skeleton more or less confused; spicules oxeate to strongylate, packed together in tracts.

Petrosia halichondrioides, n. sp.

Station 6079, one specimen.

Sponge a cake-shaped fragment, about 50 mm. diameter, with a thickness of 15 mm.; outer surface convex and bearing one small excentrically placed osculum 3 by 1.5 mm. Surface even and slightly pilose. Consistency very dense and firm, though not hard; sponge becoming hard and brittle on drying. Color: Exterior, chocolate-brown; interior, somewhat lighter.

Canal system of such a character that the sponge body is divided into trabeculæ of a more or less uniform width (commonly about 60 μ), the canals between being as wide or wider than the trabeculæ. In the superficial region, the trabeculæ and intervening canals in some places, but not universally, run more or less vertically to the surface; in the interior, they pursue a meandering course. Spicules in the trabeculæ form tracts (scarcely bundles), which are vaguely defined, because the spicules are so loosely packed, without perceptible spongin. The tracts vary in thickness and distinctness, the larger ones sometimes running more or less vertically to the surface, again pursuing a tangential course. Following the anastomoses of the meandering trabeculæ, the tracts of spicules form a quite irregular and vaguely defined reticulum. The tracts of spicules in the trabeculæ of the superficial region pass, often very obliquely, into vaguely defined brushes of spicules which project radially from the surface.

Dermal membrane indistinctly differentiated from subjacent tissue, perforated by numerous, diffusely scattered, rounded pores about 40 μ in diameter. The spicules lying between the pores give rise to a loose reticulum. These spicules are merely the outermost layer of the main skeleton.

Spicules are slender for a *Petrosia.* Oxea 160 μ by 4 to 5 μ, smooth and slightly curved; very commonly somewhat irregularly bent in the middle, or sometimes with a slight prominence at that point.

On comparing this species with a more typical *Petrosia*, such as *P.* (*Schmidtia*) *aulopora* Schmidt, we find that the regularity of arrangement in the canal system and skeleton of the latter, produced by the crossing of radial and tangential canals and spicule bundles, is absent in the Porto Rico species. Again, in the latter the spicules are much less closely bound together to form bundles, and the canals separating the trabeculæ are not so wide. Hence *P. halichondrioides* is the denser of the two species. The loosely arranged spicules of the Porto Rico species suggest a close affinity with *Halichondria*. The spicules of the Porto Rico form are slenderer than in *P. aulopora*. In a specimen of the latter species, in the Museum of Comparative Zoology, the oxea measures 152 by 7 to 8 μ, is smooth, sharp-pointed (with exceptions), and somewhat curved or bent at the middle.

Genus FOLIOLINA O. Schmidt (1870).

Sponge a hollow stem with horizontal, lamellate processes embracing the stem. Upper end closed. Oscula absent. Texture loose, spongy. Spicules rather stout oxeas, which form polyserial tracts as well as a network. Tracts developed especially in the stem, though also radiating out into the processes.

Foliolina peltata O. Schmidt.

Foliolina peltata, O. Schmidt, 1870, p. 42, pl. IV, fig. 4.

Station 6067, seven specimens.

One specimen nearly perfect, 120 mm. long, with stem diameter of 6 mm.; radial length of lateral processes, 7 to 10 mm. Processes, of which there are six in this specimen, are at upper end of stem; lower end broken across, open. There are six other fragmentary specimens, in three of which the stem divides near upper end.

The lamellate appendages are flattened hollow lobes into which the axial cavity of stem is prolonged. Appendage convex above, concave below, and more or less incised round the margin. The only pores visible are on lower surface of appendages.

Skeleton. Oxea, 320 by 10 μ, somewhat curved or bent in the middle, rounding off at each end to a sharp point. Wall of the stem, which is firm and 0.5 mm. thick, is supported by a dense renierine reticulum strengthened internally by polyserial bundles, which cross so as to produce a coarse network; superficially armed with projecting spicules. Skeleton of lower wall of appendage consists of a reticulum strengthened internally by radiating bundles of spicules. Upper wall supported by a reticulum, without the bundles; outer surface armed with projecting spicules. Cavity of lobe contains a good deal of sand. Soft parts of this interesting sponge have been almost completely macerated out.

Subfamily CHALININÆ (CHALINEÆ) O. Schmidt.

Spongin unites, usually envelops, the spicules so as to give rise to a distinctly fibrous skeleton.

Genus PACHYCHALINA O. Schmidt (1868).

Not tubular; skeleton composed of stout fibers, containing numerous spicules, arranged in several rows.

Pachychalina mollis, n. sp.

Station 6072, ten specimens; station 6075, one specimen; station 6079, two specimens.

Sponge body branching from the base. Branches, which themselves may divide, subcylindrical, long, 8 to 15 mm. diameter. Surface nearly smooth. Consistency compressible and elastic; rigidity insufficient (in the wet specimen) for the body to stand erect; body, on drying, becoming stiff and capable of standing, retaining its elasticity. Oscula 2 to 3 mm. diameter, arranged on one side of the branch in a not strictly uniserial row, commonly 10 to 15 mm. apart. Height of a specimen, from base to tip of longest branch, 400 mm. Color, grayish-brown, but with abundant traces of purplish-red, probably the natural color.

Skeleton.—Characteristic spicule is an oxea, about 140 by 7 μ, slightly curved and terminating suddenly in points. Oxea occasionally straight; rarely with one end strongylate; still more rarely, with one end strongylate and the other tylote. A slender modification (stage in the growth?) of the characteristic oxea, present in some abundance; 140 by 2 to 3 μ, with tapering ends.

Arrangement of spicules in body complex and irregular. Spiculo-fibers fairly abundant, 20 to 40 μ diameter, spicules crowded. Most conspicuous fibers (primary) extend vertically to surface; others cut these at a varying angle; others curve, following course of canals. In addition the parenchyma contains spicules in part scattered without order, in part arranged in uniserial or slender polyserial tracts. Such tracts, together with the scattered spicules and spiculo-fibers, give rise to an irregular meshwork; mesh varying greatly in shape, frequently with diameter equal to the spicule length. Spongin pale, not forming a distinguishable sheath over larger spiculo-fibers (needs to be demonstrated in glycerin).

In the dermal membrane similar spiculo-fibers, 20 to 80 μ diameter, make a close meshwork; meshes rounded and commonly 150 to 250 μ diameter.

Species closely akin to *P. megalorrhaphis* R. & D. (Ridley & Dendy, 1887, p. 23; pl. v); also to *P. lobata*, var. Ridley (Ridley, 1884, p. 404).

Pachychalina amaranthus (Duchassaing et Michelotti).

Phorbas amaranthus, Duchassaing de Fonbressin et Michelotti, 1864, p. 92, pl. xxi.
Phorbas amaranthus, Carter, 1882, p. 287.

Station 6079, three specimens.

Sponge more or less cylindrical, branching from an attached, sometimes creeping, base; branches often bent. Diameter, 10 to 20 mm.; length of longest branch, 150 mm. Color, purplish brown.

Surface covered with numerous slender conuli, 2 to 3 mm. high, projecting outward and upward; conuli in lower part of body becoming smaller, less abundant, projecting outward. Dermal membrane supported by a skeletal reticulum with meshes sufficiently coarse to be easily seen with the eye when the pores are open. Dermal membrane overlies abundant subdermal spaces or canals, and through it the sponge tissue separating such spaces may be seen as a coarse reticulum, surface of the sponge thus acquiring an areolar appearance. This areolar appearance may be absent in certain parts (is absent over nearly whole surface in one specimen); dermal membrane appearing imperforate to the eye, and concealing the internal arrangement of cavities and trabeculæ. Dermal membrane in such places shows under the microscope but few pores; and the appearance of such parts is therefore probably due to closure of the pores, and not to greater age, as Carter (l. c.) believed was the case.

Scattered abundantly over the surface are depressed, more or less circular, areas, about 2 mm. diameter, each consisting of a continuous membrane perforated in the center by a small aperture. On or in the membrane are scattered sand grains, foraminifera, broken pieces of foreign spicules, together with many spicules, most of which are foreign, arranged radially. The physiological significance of such membranous areas, which are present in other chalinine sponges, demands further study. Oscula, for the most part about 3 mm. diameter, are abundant over the upper surface; a few present on that part of the surface which looks down. Inner mass of body coarsely porous; in section, total canal area visible to eye is greater than the sponge tissue seen. Consistency firm, but body moderately compressible and elastic.

Skeleton.—(1) Characteristic spicule is an oxea, 200 to 220 μ by 6 to 7 μ, slightly curved or somewhat bent in the middle, and gradually pointed. (2) Much slenderer, rhaphid-like oxeas are abundant, 160 by 2 μ, or somewhat smaller; slightly curved, occasionally in an undulating fashion, and with tapering points. Transitional forms between (1) and (2) are found. A modification of the characteristic spicule is fairly abundant, in which one end is strongylate.

In the dermal membrane spiculo-fibers, diameter of which varies greatly, between 20 and 250 μ, form a coarse reticulum; meshes commonly 200 to 500 μ diameter, irregular, but sometimes rectangular. From the strands of this reticulum tufts of spicules project outward at short intervals. Such tufts are about a spicule in length, and more often consist of a very few, about 3 to 6, spicules; sometimes stouter, containing a dozen or more spicules. In the interior similar spiculo-fibers form an irregular reticulum, meshes varying in size greatly. Free spicules are scattered in some number through parenchyma, and a few such lie in the dermal membrane. Spongin very pale and scanty, not forming a distinct sheath for the spiculo-fiber, although a thin film probably extends over surface of the fiber. This film, in a glycerin mount, is obvious in places, particularly in the angles between bundles and over projecting separate spicules.

Pachychalina rubens (Pallas)

Amphimédon arborescens, Duchassaing de Fonbressin et Michelotti, 1864, p. 79, pl. XIV, fig. 2.
Chalina rubens, Carter, 1882; p. 276.
Euchalinopsis rubens, Lendenfeld, 1887, p. 744.

Playa de Ponce light-house reef, one specimen; station?, one specimen.

Form variable, but often "extended into long processes characterized by large round vents. Texture firm, resilient. Color dark or light crimson-red" (Carter). Thickly set, rounded, squarish, or polygonal subdermal spaces, which are continued directly into canals, give the surface a porous appearance. In places, particularly at the upper end of specimens, these spaces have the linear arrangement shown by Duchassaing et Michelotti (l. c., pl. XIV, fig. 2), the tissue between the spaces corresponding to the "nervures." Interior excavated by large cavities, about as wide as the comparatively solid tissue separating them. Margin of the oscula ("vents") not usually elevated as in Carter's specimens, but as a rule forming a sharp inwardly projecting edge.

Skeleton.—The oxeas measure commonly about 160 by 4 μ. In the spiculo-fibers the spicules are not arranged very compactly, not filling the fiber. Main fibers (vertical to surface) commonly about 100 μ thick, with spicules in about eight rows; connectives 60 μ and less, with spicules in six or fewer rows. Regularity of meshwork, formed by main and connecting fibers, is interfered with by numerous spicules, scattered individually or in slender, loose tracts (in both cases surrounded by spongin), which irregularly subdivide the mesh. Spongin of spiculo-fiber abundant, though pale. Skeletal meshwork close; meshes with rounded corners (glycerin preparation), and about twice width of intervening fibers. Meshes of dermal reticulum squarish or polygonal, about 170 μ diameter; dermal fibers lying over the subdermal spaces slenderer than those over intervening regions.

Pachychalina areolata, n. sp.

Station 6088, one specimen.

Species evidently very close to *P. amaranthus* D. et M. A larger number of specimens may show transitional forms.

Sponge body a flattened mass rising up into lobes, some of which are digitate, others compressed. Thickness of lobes, and likewise of connecting basal portion, varies from 10 to 20 mm. Conuli absent. Surface smooth and coarsely reticular: studded with circular membranous areas, 1.2 mm. in diameter, perforated in the center. Oscula 3 to 5 mm. diameter abundant, at or near ends of lobes, on lateral surface of digitate lobes, on edges of flattened lobes. Oscula open into large single undivided canals, which in many cases extend for some distance into body of sponge, which is nevertheless not tubular (siphonochaline). Consistency firm, but compressible and elastic. Alcoholic specimen colorless.

Interior extremely porous, as in *Pachychalina amaranthus*. Directly beneath dermal membrane is a single and fairly regular layer of rounded subdermal spaces, about 1.2 mm. in diameter, separated by narrow vertical trabeculæ of spiculo-fiber, which support the dermal membrane. Owing to the coarseness of dermal reticulum, these trabeculæ may be seen in surface view. Pores in meshes of dermal reticulum rounded, 50 to 350 μ diameter; absent in some of the meshes.

Skeleton.—Spicules. Oxea smooth, slightly curved, tapering to sharp points, 200 by 8 μ; occasionally rounded at one end. Very slender rhaphid-like oxeas, 160 by 2 μ, are found; transitional forms between these and the typical spicule common.

Spongin of spiculo-fiber abundant, containing numerous and not very compactly arranged spicules. Fibers in general coarse, of variable diameter, often about 140 μ, though varying from 80 to 425 μ. Except in the peripheral region where there are fibers vertical to surface with some transverse connectives, fibers form an irregular and coarse network. Abundant free spicules scattered through the parenchyma.

Supporting reticulum of dermal membrane consists of spiculo-fibers, like those of interior, of varying thickness, often 60 to 70 μ, forming meshes about 600 μ in diameter. Meshes sometimes subdivided by one or two slender, often uniserial fibers. Tufts of spicules united by some horny matter and usually less than a single spicule in length, project outwards at frequent intervals from dermal reticulum. The perforated circular membranous areas, referred to above, are loaded with sand grains and spicules, many of the latter being foreign fragments.

Pachychalina aurantiaca (Lendenfeld) Dendy, var. **dura**, n. var.

Cladochalina aurantiaca, Lendenfeld, 1887, p. 768.
Pachychalina aurantiaca, Dendy, 1894, p. 241.

Station 6079, one specimen.

Body digitate and branched. Total height, 90 mm.; diameter, 8 to 15 mm. Surface smooth. Abundant small subdermal cavities. No oscula. Pores where open, round and 60 to 80 μ diameter. *Consistency very firm.* Color, light brown.

Skeleton.—Spicules. Oxea 160 to 200 by 4 μ, smooth, slightly curved, and sharp-pointed. Very slender young stages of same spicule common.

Stout longitudinal spiculo-fibers, 130 to 170 μ thick, lie in axis of body. From these equally stout branches curve outward, dichotomizing more or less as they go, toward surface; just below which they expand, breaking up into radial tufts. The tufts are connected by tangential fibers, which support the dermal membrane. Connectives present both between longitudinal and radial main fibers, transverse or oblique polyserial bands always short, slender or about as thick as main fibers. In places proper connectives can not be said to exist, the main fibers here being so closely approximated as to fuse. The connectives for the most part are placed at such varying levels that the meshwork is irregular. In places, however, they form continuous lines, which may be approximately straight and parallel to surface; or, when deeper in interior, curvilinear and arching from surface to surface across the branch. Meshes very coarse, and as a rule much longer than wide. Fibers thickly packed with spicules; spicules also strewn in great abundance between the fibers. (Thick slices from which parenchyma has been removed with potash particularly useful along with ordinary sections.)

Dermal membrane in addition to the radial tufts contains abundant tangentially strewn spicules, especially noticeable where pores are closed. The tangential fibers above alluded to, which lie directly beneath and support the membrane, are about 50 μ thick, and of same character as fibers of interior; meshes inclosed by them, polygonal, frequently triangular, and about 170 μ wide.

Genus SIPHONOCHALINA O. Schmidt (1868).

Tubular forms; tubes smooth both inside and out, each with a large opening at the summit.

Siphonochalina procumbens (Carter) Dendy.

Patulosculа procumbens Carter, 1882, p. 635.
Siphonochalina procumbens Dendy, 1890, p. 355.
Siphonochalina procumbens Dendy, 1894, p. 245.

Station ?, one specimen.

Sponge a repent, compressed, cylindrical mass, not excavated by a *continuous* cavity; bearing a number of short vertical inflated oscular tubes. Specimen macerated; skeleton light amber color.

Skeleton.—Spicules slightly curved oxeas, about 75 by 4 μ. "The skeleton is a beautifully symmetrical, rectangularly meshed reticulation of stout, horny fiber, rather sparsely cored by short, hastately-pointed oxeas. In the secondary fibers the spicules are arranged uniserially, and at some distance from one another; but in the primary fibers they are polyserially arranged and form a continuous axial core. The diameter of the fibers is about 0.07 mm., there being little difference between the primaries and secondaries in this respect. Toward the inner surface of the tube wall the network becomes irregular and very wide-meshed. The dermal skeleton is a polygonally meshed reticulation of stout, horny fiber, cored by sparse, uniserially arranged, oxeate spicules" (Dendy).

The Porto Rico specimen differs from the descriptions given by Carter and Dendy only in the character of the dermal skeleton, which is not quite smooth, but covered with villi. The villi are short, horny processes, including each a number of loosely arranged oxeas; produced by the extension of the main and secondary radial fibers. Secondary radial fibers are those intercalated between the main fibers; confined to the peripheral region. Villi, as well as a special network, are absent over the gastral surface.

Siphonochalina procumbens (Carter) Dendy, var. **infirma**, n. var.

Station 6079, one specimen.

Sponge body divided into three tubular, probably repent, branches, fused with one another in spots; longest tube divided terminally into three short, wide, diverging branches, each with terminal osculum; one of the other tubes with single terminal osculum; remaining tube broken. None of the short upright oscular tubes characteristic of type are present. *Paragastric cavity continuous throughout sponge*, and about 15 mm. diameter. *Tube wall thinner than in type*, only 2 to 3 mm. thick. Length of longest tube, 150 mm. Color dark amber, with purplish tint.

Skeleton.—Fibers of the general skeleton slenderer than in type, about 40 μ diameter. Dermal skeleton, a network of *slender* fibers, commonly about 8 μ thick, with meshes 100 to 120 μ diameter. From dermal surface small horny villi project, containing a few, sometimes only one, spicule; villi not exclusively situated at nodes of network, viz, not all peripheral extensions of radial fibers. Gastral surface also provided with a special skeletal network very similar to that of dermal surface; villi longer and thicker than on dermal surface, spicules of a villus often forming a pretty compact bundle. The origin of the dermal and gastral networks can readily be made out in this variety. In places the most superficial meshes of the general skeleton are simply subdivided by finer fibers, which extend between and only exceptionally overlie the coarser skeletal fibers. Elsewhere the system of fine fibers has reached a further stage of development and forms a *continuous* reticulum overlying the skeletal fibers.

Siphonochalina spiculosa Dendy.

Siphonochalina spiculosa Dendy, 1890, p. 351, pl. LVIII, figs. 2, 2*a*; pl. LXII, fig. 3.

Station 6079, three specimens, fragmentary.

The habitus of these fragments is interesting when compared with the typical *Siphonochalina* form of body. One specimen is 160 mm. long, of a cylindrical or in places flattened cylindrical shape; diameter 10 to 20 mm., except in the middle where body is twice as thick; broken off at both ends. On this specimen are five of the large pseudogastral orifices, which in *Siphonochalina* are typically found at the ends of tubular branches. Here all five are lateral, and distributed round the surface; two are flush with the surface; two are at the ends of very short, wide elevations; and one is near, but not at, the end of a somewhat more marked elevation. Another specimen consists of a cylindrical piece 60 by 20 mm., broken off at both ends, and bearing a somewhat slenderer and longer branch, also broken at the end. On this specimen are two of the large apertures, both strictly lateral (not at the summit of any elevation whatever).

Pseudogaster is narrow, somewhat winding in its course, diameter for the most part about 5 mm.; in places pseudogaster so narrowed as to be nearly interrupted. The transition in habitus and with respect to the pseudogastral system offered by these specimens to the *Pachychalina* type is obvious. Should the pseudogaster become quite discontinuous and the orifices strictly lateral, the sponge would have assumed the character of a *Pachychalina*. In both *S. intermedia* R. & D. and *S. annulata* R. & D. (Ridley & Dendy, 1887, pl. VII), it may be noticed that some of the orifices are not at the ends of tubular branches, but at the summit of small protuberances on the side of a branch or main axis.

The outer surface in two of the specimens, where intact, is marked with abundant depressed membranous areas, more or less circular, perforated in the center, about 1 mm. diameter. Such areas frequently connected together so as to form grooves or channels of varying length, often meandering. In the third specimen, surface shows faintly marked, irregular indentations, but the membranous areas are absent. The membranous areas overlie subdermal spaces of corresponding shape. Color of intact surface reddish purple. Consistency firm, hard; body incompressible.

Skeleton.—Spicules. Characteristic oxea, 140 to 160 μ by 4 to 6 μ. Very slender forms of the same spicule, often about 120 by 2 μ or somewhat smaller, are fairly common; transitional forms to characteristic spicule present. A modification of characteristic oxea, with one end strongylate, occasionally found. Spiculo-fibers stout, containing very numerous spicules, with but little spongin. Primary fibers about 60 μ diameter, and somewhat slenderer secondary fibers, may be distinguished, meshwork more or less rectangular, but rather irregular; meshes wide. On inner surface of tube-wall longitudinal fibers distinguishable. Spicules also scattered freely in parenchyma. "The dermal skeleton on the outer surface of the tubes consists of a fairly close, polygonally meshed reticulation of stout spiculo-fiber, containing a very large proportion of spicules and but little spongin; the average diameter of the fibers is about 0.03 mm. The ends of the primary fibers of the main skeleton form projecting nodes in the dermal network" (Dendy).

Genus SPINOSELLA Vosmaer (1887).

Tubular forms; inner surface of tubes smooth, outer covered with "spines, warts, or prominent ridges" (Dendy).

Spinosella sororia (Duchassaing et Michelotti) Dendy.

Tuba sororia, Duchassaing de Fonbressin et Michelotti, 1864, p. 46, pl. VIII, fig. 1.
Siphonochalina papyracea, O. Schmidt, 1870, p. 33.
Spinosella sororia, Dendy, 1890, p. 360.

Station 6063, one specimen (dried); station 6079, one specimen.

The dried specimen consists of eight tubes, somewhat fused, radiating from the base. Other specimen consists of three tubes, somewhat fused, radiating in one plane, in a fan-like fashion, from base. All tubes open terminally by large apertures. Typical tube 150 by 25 mm.

Skeleton.—Spicules are slightly curved oxeas 75 to 90 μ by 3 μ. Main skeleton consists of a polygonally meshed reticulation of stout horny fiber, sparsely cored with spicules, which are much more abundant in the primary than in the secondary fibers. Dermal skeleton, a polygonal reticulation of slender fibers, 8 to 24 μ thick; fibers cored by uniserially arranged spicules; meshwork close, side of mesh about equalling length of spicule.

Inner surface of tubes marked with longitudinal veins, in which the skeletal fibers are stouter and make a closer reticulation than elsewhere; veins project freely round margin of terminal orifice. Inner surface also provided with projecting plumose bundles of spicules. Outer surface covered with strong spines, which project upward and outward from above-mentioned veins.

Family HETERORRHAPHIDÆ Ridley & Dendy.

Skeleton reticulate, never plumose. Megascleres of various forms. Microscleres usually present, but never chelæ.

Genus OCEANAPIA Norman (1869).

"Sponge consisting of a central body with closed or open tubular processes (fistulæ) projecting from it. Megascleres oxea or strongyla. Microscleres in the form of sigmata, or altogether absent. Skeleton usually coarsely spiculo-fibrous; with a bast-like reticulation beneath the dermal membrane." (Dendy.)

Oceanapia oleracea (O. Schmidt).

Rhizochalina oleracea, O. Schmidt, 1870, p. 35, pl. IV, fig. 1.

Station 6079, one specimen.

Body tuber-like, with tubular processes arising from both upper and lower surfaces. In Schmidt's specimens "the flattened upper end is surrounded by tubes, dividing two or three times, and ending in numerous vesicular inflations clustered in rows." In the Porto Rico specimen the upper processes are stout and stiff, and do not divide; vesicular inflations elongate, narrowing toward apex. The lower processes, "roots," are also undivided, long, slender, and flaccid.

Skeleton.—The only spicules are oxeas, about 140 by 5 μ, with variable points; points often suddenly sharpened, end of spicule becoming concave; or end may taper gradually, without terminal concavity; or end may rarely be rounded. Spiculo-fiber forms a reticulum. Spicules very abundant in the fiber, also scattered in meshes of reticulum.

Genus TEDANIA Gray (1867).

"Megascleres of two kinds: (1) Monactinal; smooth styli forming the main skeleton; (2) Diactinal; tylota, strongyla, or tornota, typically dermal. Microscleres always present in the form of hair-like rhaphides." (Dendy).

Tedania digitata O. Schmidt.

Reniera digitata, O. Schmidt, 1862, p. 75, pl. VII, fig. 11.
Tedania, O. Schmidt, 1870, p. 43.
Tedania nigrescens, Vosmaer, 1887, p. 338.
Tedania digitata, Ridley & Dendy, 1887, p. 51, plate XI, fig. 3.
Tedania digitata, Dendy, 1887, p. 158.
Tedania brucei, H. V. Wilson, 1894, p. 320, pls. XIX, XX.

Mayaguez Harbor, several fragments.

The fragments, which seem to have formed a large massive sponge, are coarsely porous, tear very easily, and are of a brown-yellow color. Preservation very imperfect.

Skeleton.—Spicules: (1) Style slightly curved and smooth, 240 by 8 μ, the chief spicule. (2) Tylote 220 by 4 μ, with slightly enlarged heads, which are minutely spined, sometimes only very slightly so spined or not at all. (3) The rhaphides are oxeas from 200 by 2 μ down through successive sizes to spicules only 40 μ long. The large forms, about 200 μ long, are the more common. In these one end is often less slender and tapering than the other, and a most minute roughening of the surface can be made out. The spicules are scattered irregularly through body, though there are ill-defined polyserial tracts (largely made up of styles), some of which extend vertically to the surface; also brushes of tylotes supporting the dermal membrane. Where several of the styles intersect they are cemented together by a small amount of spongin, and thus a vague and quite irregular reticulum is formed.

Schmidt (1870, p. 43) has shown how extremely variable is the habitus of the widely-spread sponges possessing the spicules mentioned above, and declines to erect new species for the West Indian forms.

Family DESMACIDONIDÆ Ridley & Dendy.

"Megasclera of various forms, usually monactinal. Microsclera always present and always including chelæ."

Subfamily ECTYONINÆ R. & D.

"Skeleton fiber echinated by laterally projecting spicules."

Genus MICROCIONA Bowerbank (Topsent emend. 1894).

Incrusting sponges. Skeleton a basal plate bearing short, upright plumose columns. Megascleres monactinal, smooth and spined. Microscleres: isochelæ, often accompanied by toxas, sometimes by sigmas.

Microciona spinosa, n. sp.

Station 6079, two specimens.

Sponge is a thin, firm incrustation covering a conglomerate mass of branched millepore coral and small lamellibranch shells. Total size of mass in one specimen 110 by 60 mm., in other 80 by 50 mm. Incrustation 0.5 mm. or less in thickness, and closely beset with spine-like radiating processes, frequently divided terminally, 1 to 2 mm. high and about 600 μ thick. (Where incrustation is apparently young the body is particularly thin and the radiating processes are just beginning to develop.) From ends and sides of the processes, and from the general surface, stout styli project 200 μ or more beyond dermal membrane. The styli, which are the echinating spicules of the horny skeleton, may be in small tufts or distributed singly. Color a dull pink.

Skeleton.—Horny skeleton consists of an extremely thin basal membrane, bearing stout radiating columns, latter forming the support of the spine-like processes. In the thicker parts of the incrustation the basal membrane may develop on its outer surface rather vaguely marked ridge-like thickenings, which by their union give rise to a strengthening network of tangential bands, thus suggesting on a most minute scale the arrangement of the trabeculæ in the honey-combed species of *Echinoclathria.* (Ridley & Dendy, 1887, pl. 31.)

Spicules.—Megascleres: (1) Stylus smooth, with the merest trace of a constriction just below rounded end, tapering to sharp point, 340 by 20 μ, with smaller sizes present; echinating the radiating columns, issuing for the most part in tufts—especially from ends, though also from sides—of columns; projecting, also, singly or in small tufts, from the basal membrane; also included as an axial string (though in places absent) in radiating columns; included much less abundantly in basal membrane. (2) Slender subtylostylus, smooth and tapering to point, 280 μ by 3 μ a common size; abundant in parenchyma; also included, but not abundantly, in the several parts of the horny skeleton, especially in basal plate. Microscleres: (3) Small palmate isochelæ 12 to 14 μ long, very abundant throughout parenchyma. (4) Toxa 64 μ long, smooth, and so slender as to be inconspicuous in balsam preparations; fairly numerous in parenchyma, abundant in places. (5) Rhaphid oxea 300 μ long, straight or somewhat curved; sparsely present here and there in parenchyma. These spicules are probably elongated toxas, as in some species of *Clathria.* I have not, however, seen transitional stages, owing possibly to the scant numbers of this spicule.

A comparison of the Porto Rico form with *Microciona prolifera* Verrill (Verrill & Smith, 1874, p. 741) is interesting. The latter species is an incrusting form on shells and stones, common from

Cape Cod to South Carolina. In it the surface exhibits no spinose projections, but bears, at comparatively great intervals, large projecting processes. Beneath the comparatively uniform surface, buried in the sponge body, are, however, small, closely set, horny columns, projecting upward from the basal plate. These columns may anastomose, the radial growth which leads to the production of the columns continuing from the new level thus formed. Where the sponge body is thin and the columns are free from one another, the horny skeleton is essentially like that of *M. spinosa*, except that the columns are closer and the surface is not molded over them, as in the latter form. The megascleres are very similar in the two species. In *M. prolifera* the large stylus measures about 250 by 16 μ; and the head, which may or may not be (in same specimen) most minutely tuberculate, is somewhat more marked (tylostylote condition) than in *M. spinosa*. Isochelæ 16 μ long, and toxas 40 μ long, are present, but in very small number. The data given relate to Beaufort (North Carolina) specimens of *M. prolifera*. The indication is that the two sets of forms may intergrade.

Genus CLATHRIA O. Schmidt (1862).

"Skeleton a reticulation of fiber, usually with much spongin, cored by smooth styli and echinated by spined styli. Typical microscleres, small palmate isochelæ" (Dendy). In addition to isochelæ, toxas may be present.

Clathria clathrata (O. Schmidt).

Tenacia clathrata, O. Schmidt, 1870, p. 56.

Station 6079, one specimen.

From Schmidt's description, the following is drawn: Sponge body consists of cylindrical branches, which may anastomose freely or may be widely divergent. Horny skeleton exceedingly well developed. Fibers yellow, echinated abundantly with spined styli; including long styli, more commonly tylostyli, and many spined styli. In the spined stylus the shaft, immediately below spinose head, is smooth; rest of shaft spinose; the sharp-pointed end again smooth. Chelæ something over 10 μ long. Very slender toxas and sigmas? (*Spangen*) present. Ends of the horny fibers extend out into the easily separable dermal layer. From each such end radiate spicules, not united by spongin, in a thick bundle. In the dermal layer are numerous brushes, spicules in a brush radiating in very divergent fashion. Between the brushes lie the same spicules, partly in tracts, partly scattered.

In the Porto Rico specimen the body is divided dichotomously into a few slender subcylindrical branches, 5 to 8 mm. diameter. Branches widely divergent on one side of specimen, on other confluent, in typical *Clathria* fashion. Surface smooth, except for scattered, mostly small, protuberances. No oscula visible. Consistency firm, hard. Color, light gray. Total height of specimen, which is not entire, 150 mm.

Skeleton.—Reticulum, formed by the stout, horny fiber, is dense and massive, nearly filling the sponge body, but stopping short of the surface. From it extend out, vertically to surface, closely set, short, strong, horny processes, which are very thickly echinated with the spined styli.

Spicules: (1) From the ends of the processes, comparatively stout, smooth styli, 300 by 10 μ or somewhat smaller, radiate; mingled with these may be equally long but slenderer subtylostyli or styli. (2) Megascleres, imbedded in horny fibers and scattered in parenchyma, are chiefly slender, smooth, subtylostyli, 200 by 4 μ to 350 by 6 μ; with some strictly stylote forms. (3) Spined stylus, echinating and included in horny fiber, 50 to 60 μ by 5 μ. (4) Dermal brushes and tracts made up of smooth, slender subtylostyli, 100 by 2 μ to 200 by 4 μ. Microscleres. (5) Isochelæ commonly 12 μ long; smaller ones present. (6) Toxas about 60 μ long, together with elongated toxas, passing by transitions into greatly elongated rhaphides, all together forming a loose bundle. No sigmas found.

Clathria jugosa, n. sp.

San Antonio Bridge, San Juan, one specimen.

I follow Dendy (1895, p. 31) in merging *Rhaphidophlus* Ehlers (1870) in *Clathria*. If *Rhaphidophlus* were to be retained, the species here described would fall in that genus. But such a form as *Clathria clathrata* Schmidt shows how impracticable it is to divide forms with, from those without, a dermal crust.

Sponge body laminate, 130 by 50 mm. with thickness of 10 mm. Lamina bifurcates at one end, plane of division being that in which lamina is compressed; both surfaces covered with conuli about

2 mm. high. Over most of the surface the conuli are arranged very distinctly in rows, which extend in parallel lines across the lamina; conuli close together, so that the rows form ridges, intervening depressions appearing as furrows 2 to 3 mm. wide. Over a part of the surface the conuli are irregularly distributed. Dermal membrane distinct and tough. No pores visible. A few small apertures, presumably oscula, 1 mm. and less in diameter, perforate the dermal membrane at the bottom of the furrows. Sponge very firm, flexible, and elastic. Color, light gray.

Skeleton.—Main skeleton consists of an irregular and dense reticulum of stout spiculo-fiber, processes from which extend up into conuli. Spiculo-fiber very variable in thickness, largely composed of horny matter, cored with (1) smooth styli 250 to 300 μ by 4 μ, tapering to sharp point, sometimes slightly bent. (2) Spined styli, 60 by 6 μ, echinating the fiber; also scattered in parenchyma. The shaft directly beneath spined head is smooth; rest of shaft spinose, terminating in smooth, tapering, sharp-pointed end (like corresponding spicule in *Clathria clathrata* Schmidt). (3) Styli similar to (1), but somewhat thicker and longer, lie freely scattered in parenchyma. (4) Stouter styli, 200 to 250 μ by 8 μ, also occur, both in parenchyma and in spiculo-fiber as well. (5) From projecting points of the skeletal reticulum multispicular bands of slender styli, similar to (1), radiate out toward the surface, expanding and becoming continuous with the dermal brushes. (6) There is a dermal crust, consisting of closely-set brushes of diverging styli similar to (1); pointed ends of styli, projecting a considerable distance beyond the surface.

Microscleres: (7) Isochelæ 12 to 14 μ long, abundant. (8) Toxas smooth, abundant. When small, 50 to 60 μ long, the shape is typical, although the curving is frequently such that the spicule does not all lie in one plane. All transitions are found between the toxas and long, hair-like oxeate spicules, up to 300 μ in length, which may be nearly straight or variously curved. Toxas and hair-like spicules frequently form loose bundles.

Genus AGELAS Duchassaing et Michelotti (1864).

"Of various form; with well-developed, horny fiber echinated by verticillately spined stylote spicules. No microsclera and no other megasclera" (Ridley & Dendy).

Agelas schmidtii, n. sp.

Siphonochalinopsis sp., O. Schmidt, 1880, p. 80.

Station 6079, one specimen.

Sponge body elongated, tubular, with a few short branches. Diameter of tube, for the most part, about 12 mm.; thickness of tube wall about 2 mm. Total length of specimen 130 mm. Surface smooth and finely pilose. Consistency firm and, in the thinner places, parchment-like. Color yellowish-brown, with a tinge of washed-out red here and there.

Oscula, 1.5 to 2.5 mm., are found at the ends of branches; also scattered over surface of the sponge body in general. In some cases osculum appears as a perforation of a smooth, depressed, membranous area, which may be rounded or irregularly elongate. In other cases osculum is not surrounded by such a membranous border. Membranous areas of this sort, which are not perforated, are scattered over the general surface. It seems probable that oscula may appear in such areas.

Dermal membrane is pierced by the thickly scattered, radially projecting spicules, which echinate the superficial skeletal fibers. Membrane also thickly incrusted with the spores and hyphæ of a fungus. No pores visible on outer surface of sponge. Membrane lining the tubular cavity exhibits scattered pores or pore areas; pores 20 to 40 μ diameter. Flagellated chambers, 16 μ diameter.

Skeleton.—Skeleton consists of a reticulum of horny fiber, echinated sparsely in the interior, abundantly at the surface, with verticillately spined stylotes. Primary fibers, 50 to 60 μ thick, about 500 μ apart; extending more or less radially, often very obliquely, from inner to outer surface; both echinated and cored by the stylotes, coring spicules abundant in some places, scanty in others. Secondary fibers, 30 to 40 μ, echinated, but not cored, by stylotes, though a spicule, imbedded longitudinally, may here and there be found; forming with one another, and with the main fibers, irregularly arranged rounded polygonal meshes of variable diameter, commonly 140 to 250 μ.

The stylote spicule, in addition to echinating and coring the horny fiber, is scattered freely in parenchyma. Spicule varies a good deal in size, from 200 by 8 μ to 90 by 4 μ; base usually truncated, occasionally pointed; distal end tapering to sharp point; as a rule four spines in each whorl. Spines are relatively longer, and the whorls more conspicuous, in the smaller and medium-sized spicules than in the largest.

Schmidt (loc. cit.) divides his *Chalinopsis* species into two groups, the one including solid forms (*Pachychalinopsis*), the other tubular forms (*Siphonochalinopsis*). Of the latter group he had but a single specimen, which he mentions was 9 cm. high, with a wall 3 mm. thick, and with spicules like those of *Chalinopsis* (Agelas). Schmidt thought it unnecessary to found a species name on such slight material. Schmidt's specimen in the Museum of Comparative Zoology is essentially identical with mine, although the wall is thicker, color is dark brown, and the whorls of spines on the spicules are somewhat more distinct, the number in a whorl usually exceeding four (6 to 8, about).

Carter (1883, p. 312) makes mention of a British Museum specimen of *Agelas* (*Ectyon*) which consists of several thick (3½ in. maximum), hollow cylinders. It seems to me unnecessary at present to separate the tubular forms of *Agelas* (*Chalinopsis*) from the solid forms.

Family AXINELLIDÆ Ridley & Dendy.

"Skeleton typically non-reticulate, consisting of ascending axes of fibers from which arise subsidiary fibers radiating to the surface. Fibers typically plumose. Megasclera chiefly styli, to which oxea and (or) strongyla may be added. Microsclera rarely present, never chelæ." (R. & D.)

Genus PHAKELLIA Bowerbank (1864).

"Sponge more or less flabellate or cup-shaped. Skeleton often more or less reticulate. Megasclera styli and often oxea. No microsclera" (R. & D.). Styli may be represented by tylostyli.

Phakellia lobata, n. sp.

Station ?, four specimens.

Sponge body usually a flattened vertical lamina 5 to 7 mm. thick; wide in the larger specimens, narrow and even club-shaped in the smallest; narrowing below to an irregular and, in some cases at any rate, incrusting base. Lamina in its upper portion is split into lobes; other lobes arise through the excessive development of ridges on either of the flattened surfaces. The underlying flabellate character is thus partially disguised by a frutescent appearance. The irregularity in the general shape may be further increased through the partial coalescence of lobes, and through the curving of the lamina by which local concavities may be produced.

Surface smooth and in a drying sponge velvety in appearance, owing to the fine projecting spicules. Very few oscula to be seen; these small, 1 to 2 mm. diameter, and disposed irregularly over one of the flattened surfaces. Pores not visible. Dermal membrane, containing the cortical brushes of spicules, is thick and well marked off from the internal body. Sponge firm, the bundles of spiculo-fiber having a cartilage-like consistency. Color, grayish brown, the inner spiculo-fiber much darker. Height of largest specimen 150 mm.

Skeleton.—Internal skeleton made up of coarse bundles which radiate upward through sponge body, occupying a large part of the interior. These are composed of correspondingly arranged, vaguely defined spiculo-fiber (tracts the spicules united by a small amount of horny matter) and scattered spicules, the whole forming a loose reticulum. From this internal skeleton bundles pass out to the surface, where they meet and mingle with closely set cortical brushes of small, diverging spicules. Latter project a short distance beyond the surface.

Spicules. (1) Tylostyli, composing the cortical brushes, 200 to 300 μ by 3 to 4 μ, with conspicuous rounded heads which frequently are pointed or slightly knobbed at the apex. (2) Similar but much larger tylostyli, commonly 650 to 850 μ by 10 to 15 μ, although forms of all sizes are found, grading down to the small ones at the surface; composing the bundles, and also scattered freely. In the large tylostyli the head, which frequently exhibits a low, knob-like elevation at the apex, is not so conspicuously developed as in the smaller forms. The tylostylote character of the spicules is a marked feature of the species.

In its external appearance this species resembles the frutescent (*staudenartig*) forms mentioned but not specifically described by O. Schmidt (1880, p. 81). It is evidently closely related to *P. flabellata* R. & D. (1887, p. 171); name of this species now changed to *P. jacksoniana* Dendy (1896, p. 236). The brushes of surface spicules are not developed round an axial larger spicule, as in the latter species.

Genus AXINELLA O. Schmidt (1862).

"Sponge typically ramose, but may be massive. Skeleton fiber plumose. Megasclera stylote and sometimes oxeate. No microsclera." (R. & D.)

Axinella reticulata Ridley & Dendy.

Axinella reticulata Ridley & Dendy, 1887, p. 184, pl. XXXVII, figs. 4, 4a.

Station 3079, one specimen.

Specimen consists of a cylindrical, upright lobe, 80 mm. by 20 mm., rising from an enlarged and broken basal part. Dermal membrane *minutely reticulate*, containing a few scattered spicules, and the brush-like ends of the radial fibers. Reticulation of dermal membrane (best seen with lens, surface under fluid) not due to skeleton, but to thickenings of dermal membrane itself. Rather numerous oscula, 2 to 3 mm. diameter, distributed over surface, not as in type at summits of oscular tubes. Surface beset with numerous small conuli. Consistency firm, sponge almost incompressible. Color, salmon-pink (type, pale yellow).

Skeleton.—"There is an extremely irregular reticulation of scattered spicules, among which one can distinguish rather loose plumose fibers running more or less vertically towards the surface" (R. & D.). In the Porto Rico specimen there are longitudinal fibers, from which radial fibers curve outward toward surface. Fibers are loose, but coarse and distinct, except in regions where the scattered spicules are crowded. Spicules in the fibers very abundant.

Spicules. (1) Chief spicule is a stout, smooth, slightly curved style, 340 by 16 µ (type, 450 by 20 µ), usually with a bend toward the base. (2) Smooth, slightly curved oxeas, of about same size as the styles, are infrequently met with.

Genus THRINACOPHORA Ridley (1885).

"Sponge ramose, with a dense central axis of spiculo-fiber; megasclera styli and (or) oxea, and (in some species) cladostrongyla. Microsclera present in the form of trichodragmata." (R. & D.)

Thrinacophora spinosa, n. sp.

Station 6072, three specimens.

Sponge body cylindrical, erect, and branching from the base. Branches lateral, but all more or less parallel; tapering gradually toward the end; after forming, may again fuse with one another. Surface covered with closely set, stiff, conuli, 2 to 3 mm. long, and about 2 to 3 mm. apart; each tapering distally to a point; and all pointing outward and more or less upward. A few divergent spicules (spicule 1), about equal in size, in number up to 5 or 6, protrude from apex of each conulus. Oscula, 2 mm. and less in diameter, are scattered, not abundantly, over surface of branches. Common diameter, excluding conuli, about 7 mm; height of largest specimen 220 mm. Color, brown. Between axial core and dermal membrane are fairly numerous subdermal spaces and canals.

Skeleton.—Skeleton of axial core consists of compact mass of spiculo-fiber; from which bundles radiate obliquely upward and outward into the superficial conuli, as may best be seen in a macerated sponge. Spiculo-fiber consists of abundant spongin, in which some of the spicules are completely imbedded, while most are only partially imbedded. Spiculo-fiber of axial core forms a network; meshes more or less rounded in transverse section, elongated in longitudinal section.

Characteristic spicules of the spiculo-fiber are (1) style, about 1,100 by 10 to 12 µ, smooth and evenly rounded at the base, tapering to a point, slightly curved. (2) Oxea, about 250 by 8 µ, smooth, tapering to not very sharp points, slightly curved or bent at the middle. Smaller forms of these two spicules are fairly common, style measuring often only 800 by 8 µ, oxea 200 by 6 µ. A less characteristic spicule is (3) style, very slender and of very variable length; often 800 to 1,100 µ by 5 µ; much smaller forms, down to 400 µ by 3 to 5 µ, also common; frequently somewhat curved in an undulating fashion.

Microsclera. In the dermal membrane (4) trichodragmata are abundant; bundles measuring about 120 µ by 8 to 12 µ. I have not been able to find them in the interior of the sponge, but this part of body is badly macerated.

Order 4. KERATOSA Grant.

Sponges in which the skeleton is composed of horny fibers without proper spicules.

Family SPONGIDÆ Poléjaeff.

Skeleton consists of reticulating fibers with very slender axial core. Flagellated chambers small, opening by special canaliculi into exhalent cavities.

Genus CHALINOPSILLA Lendenfeld (1889).

Branching, generally digitate *Spongidæ*, with smooth surface and reticulate dermal skeleton. Connecting fibers generally unbranched, forming with the simple main fibers a network with square meshes 0.2 to 1 mm. wide. Imitating Chalinids.

Chalinopsilla pilosa, n. sp.

Station 6080, one specimen.

Sponge body solid, consisting of two diverging somewhat flattened cylindrical processes united at the base. One process has a length of 100 mm., the other of about 30 mm.; diameter varying from 8 to 17 mm. Both processes have rounded ends. Color a dull purple, pinkish inside.

Surface with minute conuli, which may be rather vaguely arranged to form ridges. Main skeletal fibers protrude slightly, giving surface a pilose character. Pores thickly scattered, leading into small rounded subdermal cavities. Small oscula, 1 to 2 mm. diameter, are found on the sides and at the ends of the digitate processes. Several of the more conspicuous lead into longitudinal efferent canals, which for some distance course along the sides of the digitate processes, separated from the exterior only by the dermal membrane; latter sunken so that the position of the canal is indicated by a superficial groove.

Skeleton.—Longitudinal fibers lie in the axis, sending off radial branches, which pass upward and outward toward the surface. The axial main fibers are about 400 μ apart, somewhat closer together than the radial main fibers, the interval between which is about 550 μ. Axial and radial fibers are alike, about 40 μ thick, with a granular core about one-third the thickness of fiber, containing spicule fragments very sparsely imbedded. Connecting fibers about 24 μ thick, without inclusions, meeting main fibers with an expanded base, which is frequently perforated. When the perforation is large the fiber appears to arise by two roots. In most connecting fibers in a glycerin preparation a very thin axial granular core may be indistinctly made out (doubtless universally present). Spongin in both main and connecting fibers faintly stratified. Connecting fibers may be quite simple, stretching from main fiber to main fiber, thus giving rise to large rectangular meshes. Such meshes may be subdivided by the intercalation between two of the main radial fibers of one or two comparatively short radial fibers, the resulting meshes being still rectangular. Or the connecting fibers are frequently somewhat bent and branched, so as to give rise to irregularly polygonal meshes, commonly with a diameter one-half or one-third the interval between the main fibers.

The radial fibers, as already mentioned, protrude some little distance beyond the surface. The most superficial connectives lie in the dermal membrane, and thus form a dermal reticulum. The closeness of the meshwork varies greatly. In places the meshes are 200 to 250 μ in diameter, while elsewhere the diameter may be three times as great. Fibers of the dermal reticulum are alike and somewhat slenderer than the average skeletal fiber, about 20 μ in diameter.

The species resembles *C. dichotoma* (Lendenfeld, 1889, p. 142, pl. 2, fig. 4; pl. 3, figs. 3, 11) perhaps more closely than it does the other species of the genus. It differs from *C. dichotoma* mainly in the character of the surface, in the frequent irregularity of the skeletal meshwork, in the variable character of the dermal reticulum, in the greater slenderness of the fibers in general, and in the exceeding scarcity of foreign inclusions.

Genus EUSPONGIA Bronn (1859).

Skeletal network pretty evenly developed throughout the, in general, massive body; fibers slender and meshes very small. Simple main fibers usually with inclusions, and finer connecting fibers without inclusions easily distinguishable, the latter branching and continually anastomosing.

Euspongia officinalis (Linnæus) var. rotunda Lendenfeld.

Euspongia officinalis var. *rotunda*, Lendenfeld, 1889, p. 269.

Ensenada Honda, Culebra, two small, flattened, massive specimens; station (?), one somewhat larger, elongated, massive specimen 80 mm. high, waterworn. Upper surface covered with minute sharp-pointed conuli, which disappear on the sides as the edge of attached under surface is reached. Color of upper surface blackish, fading away on the sides into livid.

Skeleton.—Main fibers have a diameter commonly between 40 and 60 μ, occasionally widening in spots; about 800 μ apart; abundantly cored with spicule fragments, rarely with sand grains. Secondary fibers measure, for the most part about 20 μ diameter. Mesh is polygonal, frequently five-sided, with both rounded and angular corners, diameter commonly in neighborhood of 200 μ, but varying considerably.

The distinctive features of the numerous varieties of the "bath sponge" are of such a vague intangible character, that I refer the Porto Rico specimens to a particular variety with considerable hesitation.

Genus HIPPOSPONGIA F. E. Schulze (1879).

Sponges with fine skeletal fibers, forming a network with comparatively small meshes, 0.1 to 0.5 mm.; in the network thicker main fibers may or may not be distinguishable. Body permeated by a system of large canals (vestibular spaces), the intervening sponge tissue appearing as septa between the canals.

Hippospongia intestinalis (Lamarck) Ridley.

Spongia intestinalis, Lamarck, 1813, p. 434.
Spongelia velata, Hyatt, 1877, p. 534, pl. XVII, fig. 8.
Hippospongia intestinalis, var. Ridley, 1884, p. 590, pl. LIII, fig. D.

Station 6079, five specimens.

Ridley (l. c.) says: "The tortuous perforated tubes are sometimes single, but sometimes form confused reticulate masses; * * * their diameter varies from about 5 to 20 mm." The Porto Rico forms differ from Ridley's and Lamarck's in the great scantiness of main sand-cored fibers. As to the relationship between my specimens and the skeletons described by Carter (1881, p. 366), under the name of *Hircinia clathrata*, I am unable to reach an opinion. Ridley regards Carter's species as a variety of *Hippospongia intestinalis*.

Sponge body in four specimens divided into two or three elongate lobes, extending out from the central body, which is insignificant, appearing merely as a fusion of the lobes. Lobes which may branch are in general free from the substratum, mostly subrepent, though in some cases ascending; irregularly cylindrical, rounded at the end, with length of about 30 to 50 mm., and diameter of about 20 to 30 mm. Lobes may be incrusting, in which case they become flattened, attached surface taking shape of substratum. The fifth specimen has a slender, somewhat tortuous, subcylindrical body, 30 mm. long by 8 mm. wide, attached by entire under surface to a *Hircinia variabilis*.

Surface, which is much incrusted, especially with polyzoa, is for the most part smooth, though areas of very small sharp conuli are found here and there. Color of surface varies from nearly black to livid purple; light-brown inside.

Large vestibular spaces having the shape of irregularly cylindrical canals, 5 to 10 mm. diameter, extend longitudinally through the lobes and excavate the central body. Diameter of the spaces as a rule considerably exceeds the thickness of the sponge tissue lying between them. Spaces separated from the exterior by the dermal membrane alone, or by only a thin sheet of sponge tissue; connecting with exterior by numerous rounded or elongate apertures, 2 to 5 mm. diameter, which are apt to form groups. Such apertures (pseudoscula) are present both at the ends and over the surface of the lobes, being mere perforations of the dermal membrane, which in immediate neighborhood of aperture, or group of apertures, forms an especially smooth area, usually, but not always, depressed below the general surface. Such areas are sometimes seen unperforated.

The lining of the vestibular spaces is smooth only where the wall consists of thin membrane. It is for the most part roughened by minute and irregularly intersecting ridges produced into excessively minute conuli. Ridges are supported by the most superficial, tangentially lying, skeletal fibers (ridges, conuli, and fibers must be examined with a lens). There are degrees in the roughening: in places, the ridges are comparatively far apart, with intervening smooth areas, and here the general surface becomes *nearly* smooth. In the lining membrane of the vestibular spaces are many groups of pores, but they are not so numerous as in Schulze's figure of the, in many respects, similar form *Cacospongia cavernosa* (1879*a*, Taf. xxxvii, fig. 14); nor are the individual groups (pore-areas) so well defined. Frequently, in place of a group of small apertures, there is one comparatively large opening. Flagellated chambers, 25 to 30 μ diameter.

Skeleton.—The macerated and dried skeleton is hard, though compressible and elastic; reddish brown externally, lighter inside, and especially light on attached surfaces. Skeletal network consists of fibers mostly about 40 μ diameter, without inclusions, forming polygonal meshes; diameter of typical mesh, 350 μ; abundant smaller meshes, and larger ones up to 500 μ diameter common. In places, both in the interior and on the surface, the meshwork becomes much closer, meshes here having diameter of about 100 μ or even less; fibers a thickness of 10 to 20 μ. On surfaces of attachment this fine network may form a continuous coating (diteliform veil). Sponge spicules are abundant in the dermal membrane and in the membrane lining the vestibular spaces.

Main fibers are variable in abundance. In particular parts of the sponge they may be abundant, about 1 mm. apart, but in general they are sparsely scattered, interval between them being about 5 to 6 mm. They extend, branching acutely as they go, from the attached surface, or simply from the interior out to the dermal surface, meeting the latter often very obliquely. Main fibers are frequently so curved that through a part of their course they lie tangentially in the walls of the vestibular spaces (course of the fibers is best seen in macerated and dried skeletons). They are cored with sand grains and sponge spicules; may be simple and about 60 μ in thickness, or double that thickness, and with irregular perforations so as to be fascicular.

Genus CACOSPONGIA O. Schmidt (1862).

Meshes of skeletal network large, many easily distinguishable with unassisted eye. Main and connecting fibers clearly differentiated. Dried skeleton less elastic and more brittle than in *Euspongia;* some of the fibers, at any rate, thick as compared with *Euspongia.*

Cacospongia spongeliformis, n. sp.

Station 6072, one specimen; station 6079, one specimen.

Sponge body cylindrical, somewhat branching. Diameter 5 to 7 mm.; larger specimen 250 mm. long. Sponge solid; with evident subdermal cavities between outer ends of radiating main fibers. Surface covered with small conical conuli about 0.5 mm. high, and 1 to 2 mm. apart; in places arranged so as to produce vaguely marked longitudinal ridges. Small oscula, 1 to 2 mm. diameter, distributed sparsely over surface. Flagellated chambers about 36 by 32 μ, with distinct canaliculi leading into the efferent canals, quite like those of *Cacospongia scalaris* as figured by Schulze (1879*a*, Taf. xxxvii, fig. 12). Consistency rather yielding; rigidity scarcely great enough for the slender sponge body to stand erect. Color: one specimen dull lilac, color faded out in spots; other specimen colorless.

Skeleton.—There are main longitudinal fibers 80 to 120 μ thick, and from 500 to 1,000 μ apart, packed thickly with sand grains and some spicule fragments; acutely forking, branches terminating in the conuli. Secondary fibers extending between main fibers, and between their branches, have a diameter commonly between 20 and 40 μ; mostly without, or with very few foreign inclusions, although the larger ones are pretty abundantly cored with inclusions (sand grains, spicule fragments). Secondary fibers join main fibers in some cases by an expanded base; in others by such a base with one or more perforations; in others again, the perforations are large enough to divide the base into two or three distinct roots. Many of the secondary fibers simple, passing undivided from main fiber to main fiber; others branch, forming coarse, irregular networks, with a mesh frequently about 400 μ diameter, variation in general being 250 to 850 μ.

In the dermal membrane are many broken and entire foreign spicules, also sand grains and foraminifer shells. Conuli round termination of main fibers particularly full of broken spicules. A commensal alga, apparently identical with the form *Oscillaria spongeliae*, discovered by Schulze in *Spongelia pallescens* (Schulze, 1879*b*, p. 147; Taf. viii, figs. 9, 10), is abundant throughout the body, although most abundant in the peripheral region.

The species in habitus resembles *Spongelia elegans* Nardo (Schmidt, 1862, p. 28; Taf. iii, fig. 5). Its skeleton is very similar to that of *Cacospongia vesiculifera* Poléjaeff (Poléjaeff, 1884, p. 59; pl. iv, fig. 2; pl. vi, fig. 9); and this, as Poléjaeff has pointed out, is essentially *Spongelia*-like. The peculiar cortical cells present in *C. vesiculifera* are absent in the Porto Rico form.

Genus STELOSPONGOS O. Schmidt (1870).

Fibers of the skeletal network comparatively stout; distinct radiating bundles (fascicular fibers) always developed, in which, radial main fibers and short transverse connectives may be distinguished.

Stelospongos sp.

Station?, one specimen.

I am unable more exactly to identify a macerated skeleton, having the shape of a flattened irregular mass 210 by 70 mm. with a thickness of 20 to 40 mm. I append the following description for the use of those who may collect in the Porto Rico waters:

Body consists of trabeculæ and plates anastomosed together with irregular spaces between. Surface in places covered with conuli 1 to 2 mm. high, and about 2 mm. apart, which may be arranged in rows; and which in such regions may fuse more or less completely to form imperfect ridges. Between the conuli lie the closely set round openings, 1 to 2 mm. in diameter, of canals running vertically to surface. Elsewhere conuli are absent; and here are found closely set oscula about 2 mm. diameter, the bounding wall of each osculum being a short tubular projection about 1 to 2 mm. high. Transitional stages between these two conditions are found, from a consideration of which it becomes plain that the tubular oscular projections are formed by a fusion of conuli.

In still other regions, in place of the conuli or oscular projections, the surface may exhibit grooves 1 to 2 mm. wide and deep, sometimes mæandriform. Such grooves are here and there imperfectly covered over by a few fibers. On the bottom of the groove the round openings of canals may be seen, or the groove appears as the oblique superficial continuation of an oscular aperture.

Conuli are the extensions of the fascicular fibers. Wall of oscular tube made up of closely set fascicular fibers with looser network between. A very loose open network of fibers, with meshes plainly visible to the eye (up to 1 mm. diameter) extends superficially between the conuli or oscular projections. The fascicles include radial, more or less parallel, fibers about 50 μ thick, some of which (sometimes one, sometimes more) are cored with spicule fragments, sand grains, and foraminifer shells. Between these run short, simple connecting fibers, often about 20 μ thick, commonly giving rise to a scalariform arrangement. Skeletal network of interior with irregularly polygonal meshes; diameter of fiber commonly 40 to 50 μ. Foreign inclusions found only in the radial fibers of the fascicles. Consistency, for a horny sponge, hard and rigid. Color of skeleton, light brown.

Genus HIRCINIA Nardo (1834).

Skeletal reticulum in general coarse, meshes 0.5 to 3 mm. wide; tracts of finer reticulation may be developed. More or less fascicular radial (main) fibers always present; and parts of internal network may also become fascicular. Fascicular fibers vary from a nearly simple condition, in which the horny mass of the fiber exhibits scattered mesh-like perforations, to a state in which the perforations are so numerous and large as to give the fiber the character of a bundle. Filaments present in the parenchyma.

Hircinia acuta (Duchassaing et Michelotti) Hyatt.

Polytherses acuta, Duchassaing et Michelotti, 1864, p. 72, pl. XIII, fig. 3.
Hircinia acuta, Hyatt, 1877, p. 518, pl. XV, figs. 20, 21; pl. XVII fig. 26.

Station?, two specimens.

Smaller specimen massive, irregular, about 50 mm. high; with one osculum, 2 by 3 mm., on the upper surface at apex of rounded protuberance; four smaller oscula flush with the surface on one side. Larger specimen also massive, 100 mm. high with transverse diameter of 50 mm.; two oscula about 3 mm. diameter at apex of truncated conical protuberances on upper surface; one smaller osculum at apex of fistular protuberance on upper surface. From the bases of the prominent conuli radiate lines, the most conspicuous of which are ridges which pass from conulus to conulus, thus dividing the surface up into a system of polygonal depressed areas, diameter of which may be as great as 20 mm. (Hyatt). In the Porto Rico specimens conuli are about 2 mm. high, 4 to 6 mm. apart; frequently divided, as Duchassaing et Michelotti state, at the summit into two or three very small projections, each of which marks the termination of one of the ridges separating the surface areas. Dermal membrane very tough. Subdermal cavities, often about 2 mm. diameter, fairly abundant; in places so extensively developed as widely to separate the dermal membrane from underlying tissue except in immediate neighborhood of skeletal pillars supporting the conuli. In the interior, canals 1 to 2 mm. diameter are abundant. On the surface are several small funnel-shaped depressions, leading into tubular holes occupied by messmates. Color: surface light gray; interior about the same; sandy fiber brown; horny matter itself amber. Living sponge, according to Duchassaing et Michelotti, is blackish.

On one and the same specimen surface in places is porous to the eye, in places non-porous. In the non-porous areas sand grains and bits of spicules are uniformly distributed through the dermal membrane, there being no reticular arrangement and no visible pores. In the porous regions the sand grains and bits of spicules present in the dermal membrane are arranged so as to form a reticulum, with more or less rounded meshes having a diameter of about 100 μ, the intervening sand cords themselves having a diameter of about 50 μ. The dermal membrane in each mesh is, as a rule, perforated by pores, of which there may only be one, more often several, up to nine; diameter of pores 40 to 80 μ. Porous and non-porous regions fade gradually into each other. Moreover, in the non-porous regions scattered here and there, in places in some abundance, are small more or less well defined circular areas approaching the size of the reticular pore areas. The dermal membrane occupying such areas is without pores and without sand grains, the arrangement of the latter round margin of area suggesting that such areas are spots from which the sand grains are withdrawing to become concentrated in bands as in the reticular region. The facts in general suggest that the pores and reticular arrangement of the sand grains may appear and disappear.

Skeleton.—In the inner portion of the sponge the skeleton consists of a coarse irregular network, main threads of which are irregularly disposed fascicular fibers with diameter 400 to 700 μ. Between the fascicles extends a very loose reticulum with meshes from about 500 to 1,200 μ diameter, formed by fibers frequently about 80 μ thick in the middle, which are usually simple, but which in vicinity of the nodes may widen out and become fascicular. Extensive areas, sometimes 3 mm. in diameter, are here and there left unoccupied by the skeleton. The distinction between main fascicular fibers and the intervening comparatively simple network can not always be made out; in places network can only be described as irregular and consisting of fibers which are simple or more or less fascicular.

From this inner skeleton strong fascicular fibers, 0.5 to 1 mm. diameter, radiate outward and upward, terminating in the conuli. Near its peripheral end the fascicular fiber narrows, becoming denser, and runs out to a point. The tracts of tissue between the radiating bundles, which are in the neighborhood of 10 mm. long and 3 to 4 mm. apart, are unoccupied by fibrous skeleton, except in the cases (which do not seem to be common) where a connecting fiber extends between the radiating bundles. Such connecting fibers as I have seen vary in diameter from 85 to 170 μ, and are simple except at the ends, where they become fascicular.

Meshes of fascicular fibers (both internal and radiating fibers), and the individual fibers of the bundle, vary greatly in size. Meshes, which frequently are elongated in the direction of the fiber, may in places appear as mere rounded perforations, frequently 100 to 200 μ in diameter, in a continuous mass of horny matter. Elsewhere the structure is much more open, but with large and small meshes in close neighborhood, meshes measuring in typical cases 850 by 170 μ, 800 by 300 μ, 180 by 180 μ. The individual fibers frequently have a diameter of about 50 μ, but vary between 20 and 100 μ.

Sand grains, together with broken pieces of spicules and some foraminifer shells, are present and usually abundant in all the fibers of the skeleton, both the individual fibers of the fascicles and the separate simple fibers. Similar foreign particles unassociated with horny matter are scattered freely through the parenchyma, and are abundant in the dermal membrane and tissue directly beneath it, forming a layer from about 40 to 120 μ thick. Throughout the sponge body the characteristic "filaments" are exceedingly abundant, in many places exhibiting an arrangement in bundles. Filaments are without spots; diameter in the middle region about 6 μ; terminal enlargement about 8 μ wide.

Hircinia variabilis F. E. Schulze.

Hircinia variabilis, F. E. Schulze, 1879c, p. 13, Taf. I, figs. 1-5; Taf. III, fig. 1; Taf. IV, figs. 1-15.
Hircinia variabilis, Lendenfeld, 1889, p. 557, pl. 36, figs. 11-14.

Station 6079, two specimens.

Shape very variable in the species. One of the Porto Rico specimens, a hemispherical mass attached by whole under surface to a *Hippospongia intestinalis*, horizontal diameter about 40 mm., with no evident oscula. Other specimen very irregular in shape, partly incrusting on shells, also associated with *Hippospongia intestinalis;* about 90 mm. long, with greatest width of 50 mm.; with several very small oscula, and one osculum 3 mm. diameter. According to Lendenfeld, the oscula are "always large and conspicuous." Pores uniformly distributed. Conuli 1 to 2 mm. high, 1 to 3 mm. apart, and rather blunt. Subdermal cavities extensive, having the character of tangentially disposed canals. Filaments abundant, and about 6 μ thick in the middle. Color: exterior, a rather light reddish purple; grayish inside.

Skeleton.—Main fibers about 200 μ thick, and 1 to 2 mm. apart, radiate from interior. These fibers for the most part simple, here and there becoming fascicular; cored with sand grains and spicule fragments. Similar foreign particles are found sparsely distributed in the connecting fibers. Lendenfeld says: "The connecting fibers are generally slightly branched, and are attached to the main fibers by two or more roots. The connecting fibers on an average are 50 μ thick. The larger meshes are about 1 mm. wide and irregularly polygonal." This description of the connecting fibers applies to parts of the Porto Rico specimens; but a commoner condition is one in which the connecting fibers form a reticulum with meshes 300 to 500 μ in diameter.

Hircinia fœtida (O. Schmidt) F. E. Schulze var. **cuspidata**, n. var.

Sarcotrogus fœtidus, O. Schmidt, 1862, p. 36.
Hircinia fœtida, F. E. Schulze, 1879 *c*, p. 29, Taf. II, fig. 3; Taf. III, figs. 2, 3.
Hircinia fœtida, Lendenfeld, 1889, p. 577.

Station 6079, one specimen.

Variety differs from Mediterranean type in having very small, sharp conuli; in absence of a differentiated axial fiber in the main bundles; in abundance of foreign bodies with which the fibers in general are cored; in greater diameter of the filaments.

Sponge massive, amorphous, about 80 mm. high. Conuli about 1 mm. high, conical, and 2 to 3 mm. apart. Several rounded oscula over upper end and over dark surface (see below), one 4 mm. diameter, others 1.5 to 2 mm. diameter. Filaments very abundant, 6 to 8 μ thick in middle. Color, blackish-brown above and on one surface; basal portion, which is somewhat peduncular, and lower part of other surface, much lighter.

Skeleton.—Main fibers radiating and projecting into conuli, densely (i. e., meshes small) fascicular; about 0.5 mm. thick and 1.5 to 2 mm. apart; individual fibers often about 50 μ, cored abundantly with sand grains, spicule fragments, and foraminifer shells. Connecting fibers freely cored with sand grains and some spicules, commonly about 40 μ thick; *forming band-like reticula* in the plane in which the main fibers lie (Schulze's figures, 2, 3, Taf. III, are characteristic). These band-like reticula in the Porto Rico specimen vary in radial length from 0.5 mm. to about 3 mm.; meshes fine. Between successive band-like reticula, large rounded meshes 1.5 to 2 mm. diameter, occupy the space separating the main fibers. Such meshes frequently much longer in a radial direction than wide; radial diameter up to about 4 mm. Connecting fibers just below dermal membrane, simple or only slightly reticular.

Family APLYSINIDÆ Vosmaer.

Skeletal fibers without inclusions and with thick and conspicuous axial core. Flagellated chambers small.

Genus APLYSINA Nardo (1834).

"Spongidæ with small ciliated chambers 0.025-0.035 mm. wide, and a skeleton composed of a loose network of pithed fibers, which are not clearly distinguished into main and connecting fibers. The surface is conulated and not protected by a stout sand cortex." (Lendenfeld).

Aplysina flagelliformis (Carter) Lendenfeld.

Hircinia flagelliformis, Carter, 1886, p. 373.
Aplysina flagelliformis, Lendenfeld, 1889, p. 412.

Station 6079, two specimens.

Body cylindrical, branching, diameter 5 to 7 mm.; length of longest specimen 100 mm. Consistency firm, but not hard. Color, a dull dark red. "The surface is uneven or slightly undulating, and covered with very small conuli 0.3 mm. high, which are about 1.2 mm. apart. In the specimens with more slender branches the conuli are smaller and closer together than in the stouter specimens.

The oscula are 1 to 2 mm. wide, scattered or arranged more or less regularly in longitudinal rows." (Lendenfeld.) Lendenfeld's specimens measured 8 to 15 mm. diameter, and reached a length of 700 mm.

Skeleton.—Skeleton is a uniform reticulum. Mesh polygonal, sometimes oval, axes about equal or unequal; diameter 600 μ to 1.2 mm. Fiber about 100 to 120 μ thick; core commonly 0.3 of entire thickness, though frequently greater or less. Fiber bright amber. Macerated skeleton moderately compact and firm, though compressible and elastic.

Carter (l. c., p. 373) says, skeleton includes sand-cored main fibers ending in conuli on surface, and transparent lateral fibers "interuniting the sand-cored filaments." No such distinction exists in my specimens, which I might, therefore, conclude are not to be identified with Carter's. Von Lendenfeld, however, who has examined Carter's type specimen, does not mention this distinction in his diagnosis.

Aplysina flagelliformis (Carter) Lendenfeld var. **anomala,** n. var.

? *Luffaria nuciformis*, Duchassaing et Michelotti, 1864, p. 60, pl. x, fig. 2.

Station 6079, one specimen.

Specimen consists of two vase-like tubes united basally, 60 by 50 mm. and 70 by 40 mm., respectively, the narrower tube tapering below. Cavity in each tube about 10 mm. diameter, extending nearly the length of the tube; opening above by large terminal aperture, which is surrounded in one case by a rim of smooth membrane. A few small oscula about 1 mm. diameter are scattered over surface. Surface extremely uneven, produced into somewhat meandering rounded ridges or rounded outgrowths, 5 to 7 mm. wide and about as high, with depressions between. The depressions are commonly a little wider than the separating ridges. At several points on the sponge surface, the ridges project as free subcylindrical processes, up to 20 mm. long. Such processes are in no wise different from short portions of the body in the elongated (typical) forms of this species. Consistency firm, rather fleshy above, hard below. Color, dull red.

The surface in its finer character (alike on and between the above-mentioned ridges) is intermediate between the type and my var. *rugosa*. In places, especially in the more fleshy portions, the conuli are no higher than in Lendenfeld's type specimens; and the ridges caused by the most superficial, tangentially lying, skeletal fibers are so slightly developed that the latter part of Lendenfeld's description, "surface is uneven or slightly undulating," applies very well. Over most of the surface the conuli, which are sharp, are 0.5 mm. or something over in height, and about 1.5 mm. apart, the connecting ridges being feebly developed. In places the surface ridges connecting the conuli are higher than elsewhere, and sharp-edged. Such ridges may appear as short, independent, meandering structures; or they may intersect, the furrows between the ridges thus becoming converted into separate, depressed, polygonal areas. In the latter case the surface acquires a honeycombed appearance; the cell-like areas having a diameter of 1.5 to 2 mm., with a depth of about 1 mm.

Skeleton.—Skeleton in color and texture is like that of the type; average diameter of the mesh being somewhat higher, meshes as large as 700 by 1,500 μ occurring. Fiber diameter 120 to 140 μ, with core 0.1 to 0.15 total thickness.

This tubular variety is closer to var. *rugosa* than to the specimens which I have assigned to the type. So close is the resemblance to var. *rugosa*, that if one of the projecting subcylindrical processes had been found as a fragment, I should undoubtedly have assigned it to this variety.

Aplysina flagelliformis (Carter) Lendenfeld var. **rugosa,** n. var.

Station 6076, one specimen; Station 6079, seven specimens.

Body cylindrical, branching; diameter 10 to 15 mm.; greatest length 400 mm. Color, reddish brown to purple. Sponge hard. Skeleton a uniform reticulum. Skeletal fiber bright amber; diameter commonly 120 to 180 μ, with a pith from 0.2 to 0.3 whole thickness; pith occasionally occupying scarcely more than 0.1 whole thickness. Diameter of the polygonal, often rounded or oval mesh, commonly 750 to 1,500 μ; one axis of mesh usually longer than the other.

Over the surface small oscula 1 to 2 mm. diameter are scattered, in some cases forming longitudinal rows. Surface here and there approaches condition found in the type. In general the surface is characterized by the development of sharp ridges connecting the conuli. The ridges may, as in var. *anomala*, appear as independent meandering structures. More commonly they intersect, giving rise to the honeycombed surface already described as occasionally found in var. *anomala*.

Aplysina fenestrata Carter.

Spongia fenestrata, Duchassaing et Michelotti, 1864, p. 36, pl. III, fig. 7.
Aplysina fenestrata, Carter, 1882, p. 272.

Station 6079, one specimen.

Carter describes the species as "massive, sessile, lobate, hollow," with "vents large, on the prominent parts of the body." In the figure given by Duchassaing et Michelotti, the large apertures are represented on the apices of mammillary lobes. The Porto Rico specimen is an irregular mass, 150 mm. long, with an average thickness of 50 mm., and apparently without a surface of attachment. It may have been held in place by a branching coral, or something of that sort. The mass is excavated by large concavities, some of which extend entirely through the body. It is thus imperfectly and very irregularly divided into lobes. At one end is a rounded aperture, 18 mm. diameter, leading into a cloaca-like depression 35 mm. deep, having a smooth inner wall. At the opposite end is a similar but smaller aperture, leading into a shallower depression. These apertures probably correspond to the "vents" of Carter's specimens. Sponge body itself is solid, and with no discoverable true oscula. Color: surface black, purplish-brown where water-worn; interior, olive-brown.

Surface is divided into polygonal concave areas, having an average diameter of about 5 mm. Such areas sometimes shallow, mostly deep; sometimes regularly 5 or 6 sided; again rounded or irregular, often owing to confluence. (Figure given by Duchassaing et Michelotti is schematic.) Dermal membrane lining concavities, shining. Where the concave areas are deep, the separating ridges become thin walls (as in the description of D. et M.). From the sharp edges of the bounding ridges, skeletal fibers may protrude, occasionally to such an extent that the lamellar structure of the skeleton is shown.

Dermal membrane over almost entire surface, quite smooth and without pores. Here and there a tract is found with a few pores, and in which the reticulate condition exhibited by the dermal membrane of many horny sponges (*Aplysina fragilis* for example) is imperfectly developed.

Skeleton.—Skeletal fibers form strong reticulate lamellæ, extending directly inward from bounding edges of the surface areas. These lamellæ meet one another at about a right angle. Skeleton is thus given a honeycomb-like character; the outer open end of each "cell" of the honeycomb embracing one of the surface areas. In each lamella the meshes are squarish, or polygonal, and 1 to 2 mm. diameter. Fiber about 200 μ thick, of deep amber color; core 0.3 to 0.5 whole thickness, and distinct (indistinct, as given by Carter). Sand grains sparsely scattered in parenchyma.

There seems to be no doubt that the Porto Rico specimen belongs to the same species as the sponges described by Carter under *A. fenestrata*. Von Lendenfeld, however (1889, p. 413), lists this species as a synonym of *A. archeri*, although the two are very different.

Aplysina fragilis, n. sp.

Station 6097, one specimen.

Sponge incrusting on coral, becoming massive at one end. Greatest length, 80 mm.; thickness, 5 to 15 mm. Color: surface dark violet, almost black; reddish violet inside. Low conuli in neighborhood of 1 mm. high, scattered over surface, usually 3 to 4 mm. apart, in places nearly disappearing. Surface reticulate except at extreme edge of specimen, where it is smooth. Reticulate character is caused by a network of low solid ridges, 85 to 170 μ thick, including depressed areas about 1 mm. diameter, which are, however, more or less subdivided by lower and narrower ridges. In each depressed area there is a considerable number of pores, 12 to 30 μ diameter, opening into subdermal cavities. No large oscula to be seen. A few small round apertures (oscula?), 0.5 mm. or less in diameter, are scattered over surface.

Subdermal cavities numerous and fairly extensive. Canals of interior numerous and large. In outer layer of ectosome are crowded granular cells giving color to surface. Remaining ectosome lighter in color, containing numerous fine spindle or branched cells in a clear ground substance. A similar light-colored tissue is abundant round some of the larger canals.

Skeleton.—Skeletal fibers form reticulate lamellæ, lying vertical to surface and meeting one another about at right angles, so as to produce a honeycomb-like structure. From outer edge of lamellæ single fibers extend radially into conuli. Diameter of the "cell" formed by lamellæ, about 4 mm. The lamellæ themselves rather vaguely developed (as compared with *A. fenestrata*), owing to fact that the meshes are not uniform in size, often irregular and large; diameter of mesh frequently 2 mm., or even larger. Skeletal fiber light brown to dark reddish-brown, fragile; 100 to 250 μ thick; core, 0.8 to 0.9 whole thickness. Sand grains and foreign spicules scattered in parenchyma, especially in basal part.

Aplysina hirsuta (Hyatt) Lendenfeld.

Verongia hirsuta, Hyatt, 1875, p. 403.
Verongia hirsuta, Poléjaeff, 1884, p. 70, pl. 10, figs. 1, 2, 3.
Aplysina hirsuta, Lendenfeld, 1889, p. 415.

Station 6079, one specimen,

Sponge consists of two cylindrical tubes, 40 mm. and 60 mm., respectively, in diameter, fused throughout their course so as to produce a roughly cylindrical, somewhat flattened mass, 320 by 100 mm. Basal surface of mass flat, slightly smaller than the likewise flattened upper end. A very large osculum, narrowed in one diameter, at upper end of each tube. Small oscula, 2 to 3 mm. diameter, abundant on lateral walls. Thickness of tube wall fairly uniform, about 12 mm.

Sponge rather fleshy and compressible. Surface very uneven, elevated here, depressed there; marked by sharp, more or less meandering ridges, or by separate conuli, both about 1 mm. high. Intervening, smooth, depressed areas, 2 to 3 mm. wide, may be polygonal, or may not be so definitely circumscribed, in which case they appear as vaguely marked furrows.

Skeleton.—Skeleton a uniform reticulum. Fiber about 100 μ diameter; pith one-third whole thickness. Mesh polygonal or irregular, 1.5 to 3 mm. wide. Skeletal fibers, protruding from the conuli and surface ridges, unite to form an extra-superficial network, having an average thickness of 5 mm., in places twice that thickness. Beneath this network the dermal membrane is intact. A similar but much thinner extra-superficial growth is found, in patches, on inner walls of the tubes. Macerated skeleton very compressible; loose.

Von Lendenfeld says "sponge rose color. The skeleton is dark brown." The Porto Rico specimen is purplish, showing a lighter olive tint in the hollows. Color of fiber in the interior is a bright amber; extra-superficial fiber is light brown.

Genus DENDROSPONGIA Hyatt (1875).

Skeleton composed of dendritic fibers, which may anastomose to a slight extent, but do not form a reticulum, as in *Aplysina*.

Dendrospongia crassa Hyatt.

Dendrospongia crassa, Hyatt, 1875, p. 401, pl. 13, figs. 1, 2, 7.
Aplysina crassa, Lendenfeld, 1889, p. 423, pl. 35, fig. 3, pl. 38, fig. 7.

Station 6079, three specimens; station ?, one specimen.

Sponge irregularly lobate, lobes massive; in some cases attached to coral, then passing at the base into incrusting condition. Porto Rico specimens have greatest length of 100 to 120 mm. Surface covered with low, sharp conuli, often about 5 mm. apart; skeletal fibers frequently projecting from conuli. Color: Surface dark violet, almost black; interior dark violet, appearing reddish in sections.

Dermal membrane over nearly entire surface, smooth, shining, and without pores. Here and there are tracts in which surface is reticulate. Reticulate appearance is caused by a network of low, flat, solid ridges about 140 μ wide, which inclose depressed pore areas about 260 by 160 μ. Pores of each area considerable in number (15 in a typical case), 12 to 20 μ in diameter, opening into subdermal cavities. In spots the reticulate condition of surface is distinct, but the pores are absent. In other places the reticulate condition is imperfectly developed. The varying character of the surface suggests that not only do the pores appear and disappear, but that with them possibly comes and goes the reticulate arrangement. Minute apertures (oscula?), about 0.5 mm. diameter, scattered over surface in some abundance. An occasional osculum, 2 to 3 mm. diameter, is also found.

Ectosome densely crowded with spindle-shaped cells; light in color. Similar tissue extends into interior, especially abundant round larger canals. Subdermal cavities are found here and there, but in general their place is taken by small canals in the ectosome. Flagellated chambers in one of my specimens measures 32 by 24 μ.

Skeleton.—The dendritic fibers composing the skeleton may anastomose to some extent, without, however, producing a reticulum; although an occasional squarish mesh, about 2 mm. diameter, may be formed. Diameter of fiber, for the most part, about 500 μ; core 0.6 to 0.8 whole thickness. Sand grains scattered sparsely, more abundantly in places, through parenchyma.

The peculiar character of the skeleton marks off *Dendrospongia* from the species of *Aplysina*. The interesting similarity between *Dendrospongia* and the *Aplysillidæ* has been pointed out by Von Lendenfeld (1889, p. 424).

Family SPONGELIDÆ F. E. Schulze.

Flagellated chambers open directly, by means of a wide mouth, into exhalent cavities. Skeletal fiber with thin axial core. Fibers in general cored with foreign inclusions.

Genus SPONGELIA Nardo (1834).

Flagellated chambers large and sac-shaped. Skeletal fibers form an irregular reticulum. Main fibers abundantly cored with inclusions; connectives also so cored, or more or less free from inclusions.

Spongelia pallescens (O. Schmidt) subsp. **fragilis** var. **ramosa**, F. E. Schulze.

Spongelia pallescens, O. Schmidt, 1862, p. 30, Taf. III, fig. 8.
Spongelia pallescens subsp. *fragilis* var. *ramosa*, F. E. Schulze, 1879 *b*, pp. 150, 154, Taf. V-VIII.
Spongelia pallescens, Poléjaeff, 1884, p. 42, pl. III, fig. 1.
Spongelia fragilis var. *irregularis*, Lendenfeld, 1889, p. 662, pl. 37, fig. 10.

One specimen, "off Punta de Melones."

Sponge consists of several upright, digitate (some cylindrical, some flattened) lobes, united at the base and here and there fused laterally. Total height of mass, 60 mm.; greatest width, 50 mm. Diameter of lobes, 5 to 15 mm. Lobes, with exception of one, solid and without terminal osculum. Exceptional lobe tubular, with a terminal osculum 3 mm. diameter leading into an axial cavity. Remaining oscula (three) about 3 mm. diameter, and on sides of lobes. Flagellated chambers measure 60 to 70 μ by 40 to 50 μ. Conuli, 1 mm. high, 2 to 3 mm. apart. Consistency fleshy, yielding, and somewhat elastic, with sufficient firmness for the sponge lobes perfectly to retain their natural shape and position when sponge is removed from the fluid. Color, blackish gray.

From the conuli radiate band-like ridges, which branch and anastomose so as to form a network, in meshes of which lie the pore areas. Only a few of the ridges are supported by skeletal fibers. Most contain merely scattered sand grains and spicule fragments, such as are found throughout the dermal membrane; also many fibrous cells; also, as a rule, closely packed cords of the commensal alga, *Oscillaria spongeliæ* (Schulze, 1879 *b*, p. 147, Taf. VIII, figs. 9, 10). The latter is extremely abundant in and just below the dermal membrane, but is nearly absent from the interior. The band-like ridges are everywhere distinct to the eye, and in regions where the pores are opened to their widest extent they become very obvious.

Skeleton.—Main longitudinal fibers, 350 μ thick, narrowing down in places to diameter of 170 μ, lie about 2 mm. apart; somewhat fascicular, and densely crowded with sand grains, spicule fragments, and foraminifer shells. Main fibers branch at acute angles, branches extending outward and upward to terminate in the conuli. Connectives vary in thickness from 100 to 60 μ, and also are for the most part thickly crowded with inclusions. In some of the smaller fibers, the inclusions are only abundant enough to form an axial string.

The system of connectives is fundamentally ladder-like, giving rise to large squarish meshes, each occupying the whole space between a pair of main fibers and having a longitudinal or radial length of about 1.5 mm. Connectives separating successive meshes of this sort are occasionally simple, but usually branch and form secondary reticula with meshes commonly 300 to 700 μ diameter. The large squarish meshes, just alluded to, are in places broken up into smaller ones by the branching of the connectives. Connectives extending between outer ends of main fibers are in many places, but not everywhere, sufficiently branched to give rise to a superficial reticulum with meshes commonly 400 to 700 μ diameter.

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* I have been unable to consult directly the memoirs marked with an asterisk.

THE FORAMINIFERA OF PORTO RICO.

BY

JAMES M. FLINT,

Medical Director, U. S. Navy.

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The foraminifera belong to the subkingdom Protozoa, class Rhizopoda; that is to say, they are among the simplest forms of animal life, consisting of a minute mass of protoplasm, or an aggregation of such masses, without organs or tissues, capable of protruding any part of the body in the shape of fine threads, which flow together whenever they touch, forming a granular network. They are aquatic, mostly marine animals, generally microscopic in size, and are inclosed in shells or "tests" composed either of calcium carbonate secreted by the animal, or of available foreign material, such as mud, sand, sponge spicules, or dead shells, united by a calcareous cement. A few species are pelagic, but the greater number of species live at the bottom of the sea.

The shells of recent foraminifera are found almost everywhere on the ocean bed, the exceptions being in the polar seas, and in the abysmal depths below about 2,500 fathoms where the shells seem to be dissolved in the dense waters. As fossils they are widely distributed and of great geological significance, since they are the source of all the chalk and much of the limestone all over the world. These calcareous strata are in process of formation at the present day, the same as in past geological ages.

There is but little on record regarding West Indian foraminifera. Few dredgings have been made in that vicinity, and fewer have been studied and reported. The *Challenger* records one dredging off Culebra Island, in 390 fathoms of water, from which 177 species of foraminifera were identified, showing that foraminifera are very plentiful in these waters in depths below the coral and above the abysses. The *Albatross* also found foraminifera in great variety and quantity along the northwest coast of Cuba.

The *Fish Hawk* expedition to Porto Rico obtained foraminifera by shore collecting at Ensenada Honda, Caballo Blanco, and Mayaguez, and with the dredge or tangle at the following seven stations:

Station No.	Locality.	Depth.	Bottom.	Instrument.
		Fathoms.		
6053	San Juan Harbor, NW. angle of Morro Castle ½ mile	4 to 7½	Fine sand.	Dredge.
6079	Off St. Thomas, Sail Rock W. by N. ¼ N. 6 miles	20 23	Coral	Tangle.
6080	Off St. Thomas, Sail Rock NW. ¾ W. 4 miles	20	.....do	Dredge.
6086	Off Culebra, Punta Mula light-house SW. ¼ S. 8½ miles	14½	Coral sand	Do.
6091	Off Vieques, Culebritas light-house NE. ½ N. 10 miles.	15	Coral	Tangle.
6092	Off Vieques Island, Culebritas light-house NE. ¾ E. 7½ miles	16	.....do	Do.
6093	Off Culebra, Culebritas light-house NE. 5½ miles	15	.....do	Do.

As will be seen, all the dredgings were in quite shoal water, with coral or coral sand at the bottom. The quantity of material gathered was generally quite small, yielding few foraminifera. Station 6093 furnished only 7 individuals, Ensenada Honda 6, Caballo Blanco 3, and Mayaguez only 2 or 3 exceedingly minute ones.

A considerable number of species is represented, but without exception the individual shells are below the typical size and appear to have been starved by the more vigorous corals among which they were found. The species best represented, both in numbers and development, are *Orbiculina adunca* and *Amphistegina lessonii*.

The following lists show, by families and stations, the species represented in the collection. Descriptions and figures of these species may be found in the Report of U. S. National Museum for 1897, under the title "Recent foraminifera; a descriptive catalogue of specimens dredged by the U. S. Fish Commission steamer *Albatross*."

LIST OF FORAMINIFERA BY FAMILIES.

- Family Lituolidæ:
  - *Ammodiscus incertus* d'Orbigny.
- Family Textularidæ:
  - *Textularia gramen* d'Orbigny.
  - *Clavulina parisiensis* d'Orbigny.
    - *eocæna* Gumbel.
- Family Miliolidæ:
  - *Biloculina lævis* Defrance.
    - *bulloides* d'Orbigny.
  - *Spiroloculina grata* Terquem.
  - *Vertebralina insignis* Brady.
  - *Miliolina linnæana* d'Orbigny.
    - *seminulum* Linn.
    - *bicornis* Walker & Jacob.
    - *tricarinata* d'Orbigny.
    - *reticulata* d'Orbigny.
    - *venusta* Karrer.
    - *bucculenta* var. *placentiformis* Brady.
    - *angularis* Flint.
    - *circularis* Bornemann.
  - *Orbiculina adunca* Fichtel & Moll.
  - *Orbitolites duplex* Carpenter.
- Family Miliolidæ—Continued.
  - *Orbitolites marginalis* Lamarck.
  - *Peneroplis pertusus* Forskal.
- Family Lagenidæ:
  - *Cristellaria cultrata* Montfort.
    - *gibba* d'Orbigny.
  - *Uvigerina pygmæa* d'Orbigny.
- Family Globigerinidæ:
  - *Orbulina universa* d'Orbigny.
  - *Globigerina bulloides* d'Orbigny.
    - *sacculifera* Brady.
    - *dubia* Egger.
- Family Rotalidæ:
  - *Pulvinulina menardii* d'Orbigny.
    - *tumida* Brady.
  - *Truncatulina rosea* d'Orbigny.
    - *pygmæa* Hantkin.
    - *præcincta* Karrer.
  - *Anomalina ariminensis* d'Orbigny.
- Family Nummulinidæ:
  - *Polystomella striatopunctata* Fichtel & Moll.
  - *Amphistegina lessonii* d'Orbigny.

LIST OF FORAMINIFERA BY STATIONS.

Station 6053: *Clavulina eocæna* Gumbel, *Biloculina lævis* Defrance, *Spiroloculina grata* Terquem, *Miliolina linnæana* d'Orbigny, *M. seminulum* Linn., *M. bicornis* W. & J., *M. tricarinata* d'Orbigny, *Orbiculina adunca* F. & M., *Orbitolites marginalis* Lamarck, *O. duplex* Carp., *Peneroplis pertusus* Forsk., *Cristellaria cultrata* Montf., *C. gibba* d'Orbigny, *Uvigerina pygmæa* d'Orbigny, *Orbulina universa* d'Orbigny, *Globigerina bulloides* d'Orbigny, *G. dubia* Egger, *Pulvinulina menardii* d'Orbigny, *P. tumida* Brady, *Truncatulina rosea* d'Orbigny, *T. pygmæa* Hantk., *Anomalina arimeninsis* d'Orbigny, *Amphistegina lessonii* d'Orbigny.

Station 6079: *Ammodiscus incertus* d'Orbigny, *Textularia gramen* d'Orbigny, *Clavulina parisiensis* d'Orbigny, *Miliolina seminulum* L., *M. reticulata* d'Orbigny, *M. venusta* Karrer, *M. bucculenta* var. *placentiformis* Brady, *Orbiculina adunca* F. & M., *Orbitolites duplex* Carp., *Amphistegina lessonii* d'Orbigny.

Station 6080: *Clavulina parisiensis* d'Orbigny, *Miliolina linnæana* d'Orbigny, *Orbiculina adunca* F. & M., *Truncatulina præcincta* Karrer, *Amphistegina lessonii* d'Orbigny.

Station 6086: *Vertebralina insignis* Brady, *Orbiculina adunca* F. & M., *Polystomella striatopunctata* F. & M.

Station 6091: *Orbiculina adunca* F. & M.

Station 6092: *Biloculina bulloides* d'Orbigny, *Miliolina linnæana* d'Orbigny, *M. reticulata* d'Orbigny, *Orbiculina adunca* F. & M., *Orbitolites marginalis* Lamarck, *Globigerina sacculifera* Brady, *Truncatulina pygmæa* Hantk., *Polystomella striatopunctata* F. & M., *Amphistegina lessonii* d'Orbigny.

Station 6093: *Textularia gramen* d'Orbigny, *Orbiculina adunca* F. & M., *Orbitolites marginalis* Lam., *Globigerina bulloides* d'Orbigny, *Truncatulina pygmæa* Hantk., *Polystomella striatopunctata* F. & M.

Ensenada Honda, Culebra Island: *Miliolina angularis* Flint. *M. circularis* Bornem, *Polystomella striatopunctata* F. & M.

Caballo Blanco Reef: *Miliolina bicornis* W. & J., *Truncatulina rosea* d'Orbigny, *Pulvinulina tumida* Brady.

Mayaguez: Collection consists of fine sand, with an occasional minute foraminifer.

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